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RABBIT DRIVING IN THE SAN JOAQUIN VALLEY, CALIFORNIA. THE GRAND ARMY DRIVE AT FRESNO, MARCH 12, 1892.
(From photograph by Stiffler.)

BULLETIN No. 8

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

THE JACK RABBITS OF THE UNITED STATES

54207

BY

T. S. PALMER, M. D.
Assistant Chief of Division

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF ORNITHOLOGY AND MAMMALOGY,
Washington, D. C., October 19, 1895.

SIR: I have the honor to transmit and to recommend for publication as Bulletin No. 8 of this division a report on The Jack Rabbits of the United States, by Dr. T. S. Palmer, assistant chief of division. Dr. Palmer has prepared the whole bulletin and is responsible for all statements made, including opinions respecting the status of the various species.

Respectfully,

C. HART MERRIAM,
Chief of Division.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

PREFACE.

The damage done to crops by rabbits has been illustrated very forcibly during recent years by the losses sustained by farmers and orchardists in the arid regions of the West through the depredations of the large native hares, or jack rabbits. The introduction of irrigation and the cultivation of large tracts of land have favored the increase of rabbits in several States by furnishing a new source of food supply. To such an extent have their depredations increased that the extermination of jack rabbits has become a serious question in California, Colorado, Idaho, Oregon, and Utah.

The objects of this bulletin are: (1) To give a general account of the distribution and habits of the various species found in the United States; (2) to show the methods which have been used to exterminate the animals and to protect crops from their depredations; and (3) to bring together facts and figures concerning the economic uses of rabbits in general, for the purpose of indicating how our native species may be more generally utilized.

The disastrous results of the introduction of the common European rabbit into Australia some thirty years ago are known the world over, and nowhere have the methods of destroying rabbits and protecting crops been so carefully investigated as on that continent. While the Old World rabbit belongs to an entirely different species from the jack rabbits of the West, and differs from them in habits, some of the Australian methods might be used with advantage in our own country. The commercial utilization of rabbits has been attended with considerable success in Australia; large quantities of rabbits are used for food, and an immense number of skins are annually exported to England, some of which find their way to the markets of this country. Therefore, when possible, reference has been made to experiments in Australia which are likely to be of benefit in the United States.

It is obviously impracticable to mention the many persons who have contributed data, but acknowledgments are due to all who have aided in the preparation of this report. The author, however, is under special obligations to Maj. Chas. Bendire and to Messrs. M. S. Featherstone of Goshen, Cal., Henry Lahann of Traver, Cal., Geo. W. Stewart and D. K. Zumwalt of Visalia, Cal., A. Van Deusen of Lamar, Colo., and

to Vernon Bailey and J. Ellis McLellan, field agents of the division, for many valuable notes. More than five hundred letters were written in the course of the investigation, and thus a large amount of information has been collected which could not otherwise have been obtained. The statistics given in the last two chapters are only approximate, and necessarily incomplete, but any corrections or additions will be welcomed, particularly in the case of the lists of rabbit drives, which it is desirable to make as complete as possible.

T. S. PALMER.

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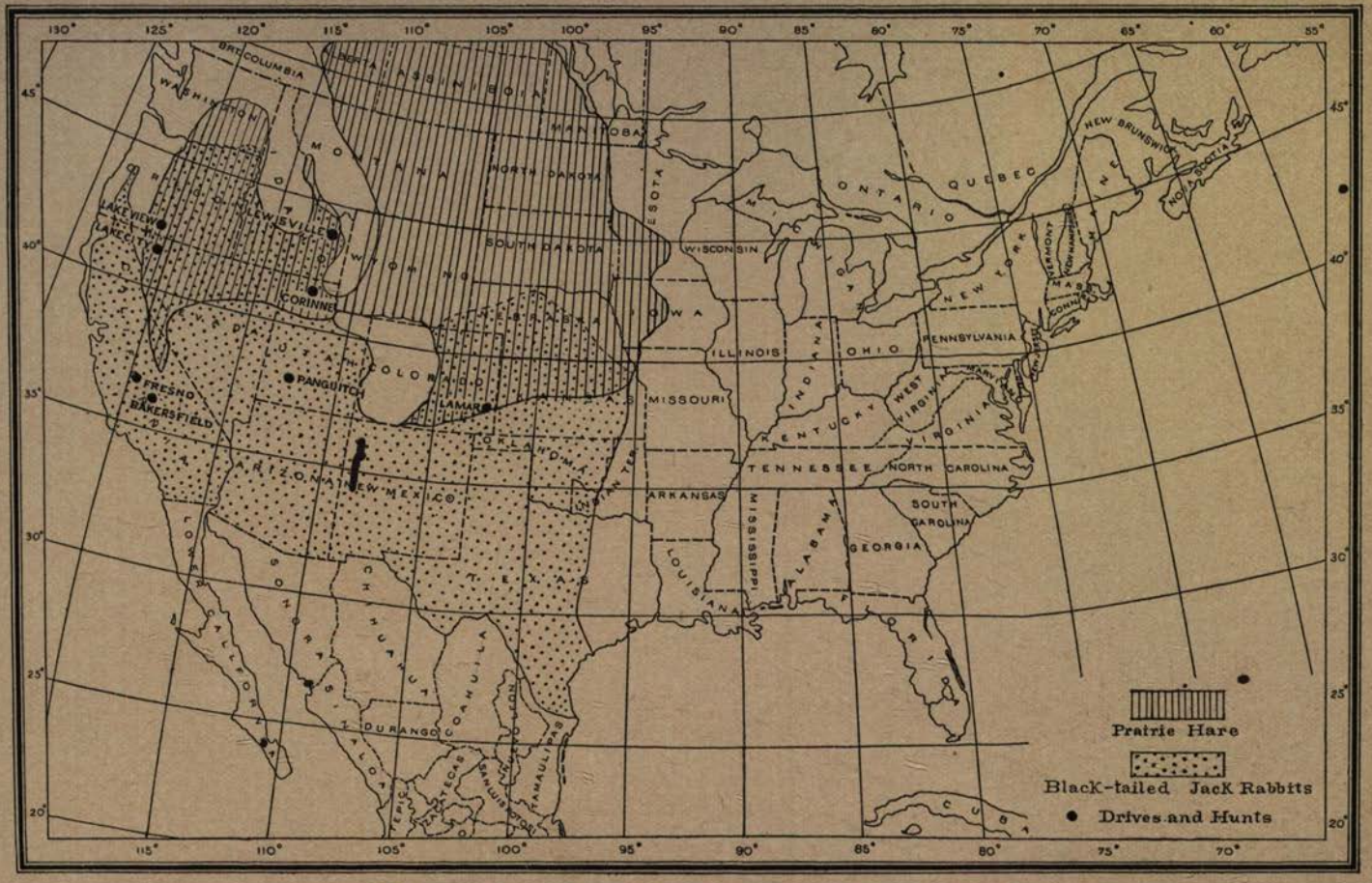


MAP SHOWING DISTRIBUTION OF JACK RABBITS IN THE UNITED STATES.

THE JACK RABBITS OF THE UNITED STATES.

By T. S. PALMER, M. D.

CHAPTER I.

INTRODUCTION.

The Great Plains and deserts of the western United States are inhabited by several species of large hares, commonly known as 'jack rabbits.' These rabbits occur almost everywhere, except in the higher mountains and in wooded regions, from the ninety-fifth meridian west to the Pacific, and from the Plains of the Saskatchewan southward over the table-land of Mexico to the Isthmus of Tehuantepec. The resemblance of their large ears to those of the well-known pack animal of the West has suggested the common names of 'jackass hares,' 'jack rabbits,'[1] or 'jacks.' In some parts of California jack rabbits are called 'narrow-gauge mules' and 'small mules,' but fortunately these absurd terms are very local, and not likely to come in general use. In the Southwest and beyond the Rio Grande the large hares are called 'liebres' by the Mexicans, to distinguish them from the cotton-tail rabbits, or 'conejos.'

GENERAL HABITS.

Jack rabbits may be seen abroad at almost any hour of the day, and hence are likely to be recognized by the most casual observer, and are perhaps better known than most other native mammals. Living as they do on the open plain, where they are compelled to rely for safety on quickness of hearing and on speed, their ears and hind legs are developed to an extraordinary degree. This gives them a somewhat grotesque appearance, but in reality few animals are more graceful as they bound along when once thoroughly alarmed. In spite of an unfortunate name and seeming awkwardness of gait, a closer acquaintance with their

[1] This name seems to have been first introduced by Audubon and Bachman in 1851. In referring to one of the species found along the Mexican border they say; "This species is called the jackass rabbit in Texas, owing to the length of its ears." (Quad. N. Am., II, 1851, p. 99); and again, in reference to *Lepus texianus*, "This hare received from the Texans and from our troops in the Mexican war the name of jackass rabbit, in common with *Lepus callotis*." (Ibid., III, p. 157.)

habits will reveal many points of interest and will arouse admiration for the way in which they seem to overcome every adverse condition of life, so admirably are they adapted to their surroundings.

Unlike the cotton-tails, or the common rabbit of Europe, these hares do not live in burrows, but make 'forms' under bushes or in patches of weeds, where they find protection from the weather, and also bring forth their young. Certain shrubs in the West belonging to the genus *Bigelovia* are commonly known as 'rabbit brush,' because they grow in dense thickets, in which rabbits are fond of hiding. Where there are no bushes, the rabbits seek the shade of any objects which can shield them from the burning rays of the sun. A traveler on the Southern Pacific Railroad, crossing the barren plains of the San Joaquin Valley in California, where large stretches of country are devoid of bushes, may sometimes see the jack rabbits crouching in the shadows of the telegraph poles, evidently alarmed by the train, but uncertain whether or not to forsake their shady spots and seek safety in flight.

Extremes of climate apparently do not affect them to any great extent. Some species are at home on the deserts of Arizona and California; others, as the Prairie Hare, contrive to exist in the intense cold of a Montana winter, when the ground is covered with snow, and they are compelled to live on the bark of shrubs or of willows growing along the streams.

Food.—Like other rabbits, they feed almost exclusively on the bark and leaves of shrubs and on herbage, and hardly any land is too poor to supply this food in some form.

On the Great Plains, buffalo and grama grass and such herbs as they can find constitute their principal fare, but this is supplemented in winter by the bark of willows. In the deserts of the Great Basin they seem to be especially fond of the tender annual species of greasewood (*Atriplex*) and several species of cactus. If nothing better is obtainable, however, they can subsist on *Sarcobatus*, and shrubs which other animals seldom touch. Sometimes it is difficult to see where they can obtain sufficient food, but lack of water and of green herbage serve only to reduce their numbers and rarely cause their complete absence from any region. Among the greasewood on the alkali flats northwest of Great Salt Lake, or on the cactus-covered deserts of Arizona, the jack rabbits are almost as fat and sleek as when feeding in the alfalfa patches and vineyards of southern California. If necessary they can travel long distances for food, but as they seldom drink, scarcity of water causes them little inconvenience, and the juicy cactus 'pads' or ordinary desert herbage furnish all the moisture necessary to slake their thirst. They are fond of vegetables and alfalfa, and when these can be had they quickly abandon their usual food and establish themselves near the garden or cultivated field. Their fondness for tender bark makes them particularly destructive in the orchard and vineyard,

where they are likely to do irreparable injury by girdling young fruit trees and vines.

As jack rabbits multiply rapidly they often become great pests. They have comparatively few natural enemies, and if not held in check by other agencies would doubtless overrun the country. Their undue increase is prevented ordinarily by lack of food, by unfavorable climatic conditions, or by disease. Many die during unusually severe winters; a cold, wet spring is disastrous to the young, and thousands of young and old perish during the epidemics which occasionally break out among them over large sections of country. Nevertheless, they can adapt themselves to circumstances to such an extent as to be able not only to hold their own under most unfavorable conditions, but to increase rapidly whenever food is abundant.

Depredations.—The experience of settlers in the San Joaquin Valley, California, along the Arkansas River in southeastern Colorado, and in southwestern Idaho has shown that where new land has been cultivated or irrigated jack rabbits fairly swarm in from the surrounding country, and instead of being driven out by advancing civilization, at first multiply so enormously that radical measures have to be adopted to protect the crops from destruction.

Some idea of the extent of these injuries can be formed, when it is stated that the damage caused by jack rabbits to the crops in Tulare County, Cal., during a single year has been estimated at $600,000, and one county in Idaho has actually expended more than $30,000 in bounties on these pests! The money spent by individual farmers in the West on rabbit fences and other devices for protecting crops would aggregate a very large sum, which it is impossible even to estimate. But the thousands of rabbits destroyed for bounties and the tens of thousands killed in the large hunts and by epidemics seem to diminish the abundance of the species only in localities where a large part of the land is under cultivation and the animals are systematically killed off year after year.

Jack rabbits are largely used for food and for sport. In a fair race they can outstrip all but the best hounds and can even keep abreast of a railway train running at a moderate speed for some distance. For coursing the native species are considered equal, if not superior, to the Old World hares. Large quantities are shipped to market every year as game, and the trade is capable of considerable increase. The skins might also be saved with profit, but the value of jack rabbits, whether for food or for fur, by no means offsets the immense damage which they do to crops.

SPECIES FOUND IN THE UNITED STATES.

This group of rabbits is unfortunately in a somewhat chaotic condition, and it will be impossible to treat the species satisfactorily until they have been subjected to a thorough revision. A technical discussion of their characters and relationships does not come within the

scope of this bulletin, however desirable it might be to consider these questions. For the present it will be sufficient merely to give the species now generally recognized, with the full knowledge that their status and nomenclature are likely to undergo considerable modification in the near future. Such a course is unsatisfactory, but unavoidable under the circumstances.

For convenience, the jack rabbits which occur in the United States may be divided into two groups, according to the color of the upper surface of the tail.[1] In the first group, represented by the Prairie Hare (*Lepus campestris*)—the only jack rabbit which ever turns white in winter—the tail is entirely white. In the second group the upper surface of the tail is marked by a more or less distinct stripe of black. Four or more black-tailed rabbits have been described from the West: (1) A buff-bellied species found in California and southwestern Oregon (*Lepus californicus*); (2) a large, long-limbed species inhabiting southern Arizona and Sonora, known as Allen's Hare (*Lepus alleni*); (3) a widely distributed white-bellied animal with long ears, occurring in the Great Basin and commonly known as the Texan Jack Rabbit (*Lepus texianus*), and (4) the Black-eared Jack, or Eastern Jackass Hare of the Great Plains (*Lepus melanotis*), very closely related to the Texan Hare, but differing from it in possessing shorter ears and richer coloring.

One or more Mexican species cross the southern border of the United States and are found in the extreme southern part of Texas, but their range within our limits is so restricted that they will not be considered further.

Prairie Hare or White-tailed Jack Rabbit.

(*Lepus campestris* Bachman.)

The Prairie Hare was first discovered by Lewis and Clark on their memorable trip across the continent in 1804–1806, although not actually named until 1837.[2] They described it as follows:

> The hare [*Lepus campestris*] on this side of the Rocky Mountains inhabits the great plains of the Columbia. Eastward of those mountains they inhabit the plains of the Missouri. They weigh from 7 to 11 pounds. * * * The head, neck, back, shoulders, thighs, and outer part of the legs are of a lead color; the sides, as they approach the belly become gradually more white; the belly, breast, and inner part of the legs and thighs are white, with a light shade of lead color; the tail is round and bluntly pointed, covered with white, soft, fine fur, not quite so long as on the other parts of the body; the body is covered with a deep, fine, soft, close fur. The colors here described are those which the animal assumes from the middle of April to the middle of November; the rest of the year he is pure white, except the black and reddish-brown of the ears, which never change. A few reddish-brown spots are sometimes intermixed with the white at this season [February 26, 1806] on the head and the upper part of the neck and shoulders. * * * His food is grass and herbs; in winter he feeds much on the bark of several aromatic herbs growing on

[1] Jack rabbits never turn the tail up like cotton-tails, and hence it is easy to tell at a distance whether the color of the upper surface is black or white.

[2] Bachman, Journ. Acad. Nat. Sci., Philadelphia, Vol. VII, 1837, p. 340.

the plains. Captain Lewis measured the leaps of this animal, and found them commonly from 18 to 21 feet. They are generally found separate, and are never seen to associate in greater numbers than two or three.[1]

The White-tailed Jack Rabbit has an extended range in the northern part of the Great Basin and on the Great Plains. It is said to be found as far north as latitude 55° in Saskatchewan and ranges eastward to Lake Winnipeg, Elk River, Minnesota, and central Iowa. On the south it is not found on the plains much below central Kansas and southern Colorado—Fort Riley and Pendennis, Kans., and Las Animas, Colo., being near its southern limits. On the Rocky Mountain plateau, however, it goes a little farther south and has been taken at Fort Garland, Colo., and at Kanab, Utah. The Sierra Nevada and Cascade Range mark the limits of its western distribution, but it occurs in the Sierra as far south as Hope Valley (lat. 38° 30′), and probably as far as latitude 36°.

Although called 'Prairie Hare,' it ranges high up in the mountains—at least in summer—higher than any other jack rabbit. In August, 1891, I saw a large rabbit, probably belonging to this species, at an altitude of about 10,000 feet in the Sierra Nevada, about 20 miles south of Mount Whitney. Signs of their presence have been found in the Rocky Mountains far above timber line and nearly to the summits of the higher peaks. It is hardly probable that jack rabbits spend the winter at such altitudes, but the upper limit of their winter range still remains to be ascertained. Abundant food in the mountain meadows and above timber line probably tempts them to ascend from lower levels in summer just as cultivated fields on the plains attract them from a distance.

In the mountains and in the northern part of their range they become pure white in winter, but in Kansas, Nebraska, Washington, and elsewhere near the southern limit of their habitat they undergo only a partial change, or do not turn white at all. In southern Oregon the rabbits inhabiting the higher mountains are said to turn white in winter, while a little lower down they undergo only a partial change and in the valleys do not assume the white pelage.

This species probably never occurs in such numbers as the Black-tailed Jack Rabbit, even under the most favorable circumstances. Dr. Coues speaks of it on the Great Plains as follows:

Nor is the Prairie Hare in the least gregarious. I have never seen nor heard of several together, and indeed it is rare to find even two together, at any season whatever. It is one of the most solitary animals with which I have become acquainted. * * * I have never found any kind of locality even, which, presenting special attractions, might invite many hares together. All places are alike to them; the oldest frontiersman, probably, could never guess with any degree of certainty where the next hare to bound off before him would appear. If it have any preference, however, it is for 'weedy' tracts, of which the sage-brush regions furnish the best examples; there it finds shelter which the low, crisp, grass of rolling prairie does not afford, and also doubtless secures a greater variety of food.[2]

[1] Coues' Edition Hist. Exped. Lewis and Clark, Vol. III, 1893, pp 865–866.

[2] Bull. Essex Institute, VII (1875), 1876, pp. 80–81.

Opinions seem to differ as to the abundance of the Prairie Hare, but it is certainly more common in many places than in the localities just described. Dr. A. K. Fisher has seen as many as 20 together near Colby, Kans., and farther north it is killed in large quantities for market. A commission house in St. Paul, Minn., reports having handled about 12,000 jack rabbits during the winter of 1894–95, most of which came from North and South Dakota, where this is the only species. Several thousand are estimated to have been killed in Codington County, S. Dak., alone during the same season. Certainly it must be tolerably abundant in these States to be obtained in such numbers. In the northern part of the Great Basin it is also abundant in certain localities, especially in southern Oregon. Complaints have recently been received from Washington that crops and young orchards near Sunnyside, in the Yakima Valley, have been seriously injured, while near Prescott, Wallawalla County, timber claims planted with black locust trees have been ruined by the White-tailed Jack Rabbit.

Farther south it was met with in considerable numbers by J. K. Lord, during his journey from The Dalles to Walla Walla. In describing the country between the John Day and the Umatilla rivers he says:[1]

"As we ride on, I noticed what I at first imagined must be the droppings of a large flock of sheep covering the ground thickly, just as though the animals had been folded. I had barely time to think what animal could be so abundant, when the dogs, tired as they were, started two or three large hares from under the wild sage bushes. We saw numbers of them, and shot several, but the flesh tasted so strongly of the wild sage, on which these hares mainly subsist, that eating it was an impossibility. The Prairie Hare (*Lepus campestris*) appears entirely confined to these sandy desert lands, being replaced by the Red Hare (*L. washingtonii*) in the timbered districts.

"The fur of the Prairie Hare is long and silky, and exactly the color of the sand and the dead leaves under the bushes where they make their 'forms.' Unless they move, it is impossible to distinguish them, although looking down on their backs." But when once startled they are off in an instant, and their characteristic actions at such times are thus described by Dr. Coues:[2]

> The extraordinary agility of this animal, which would be inferred from inspection of its lithe yet muscular and free-limbed shape, has always attracted attention. * * * The first sign one has usually of a hare which has squatted low in hopes of concealment, till its fears force it to fly is a great bound into the air, with lengthened body and erect ears. The instant it touches the ground it is up again, with a peculiar springy jerk, more like the rebounding of an elastic ball than the result of muscular exertion. It does not come fairly down, and gather itself for the next spring, but seems to hold its legs stiffly extended, to touch only its toes, and rebound by the force of its impact. The action is strikingly suggestive of the 'bucking' of a mule, an affair with which people in the West are only too familiar. With a succession of these high jerky leaps the animal makes off generally in a straight

[1] Naturalist in British Columbia, II, 1866, pp. 95–96.

[2] Bull. Essex Institute, VII (1875), 1876, pp. 83-85.

course; there is nothing of the dodging or scuttling about that marks the running of the smaller rabbits. As it gains on its pursuers, and its fears subside, the springs grow weaker, just as a flat stone 'skipped' on the water diminishes in length of the rebounds, and finally the animal squats in its tracks on its haunches with a jerk, to look and listen. * * * The attitude at such times is highly characteristic. One fore foot is advanced a little before the other, and the ears are held pointing in opposite directions. A hare in such an attitude as this is always upon the watch, and the slightest stimulation of its fears at such a time is enough to start it on its bounding course. It is a beautiful exhibition of timid watchfulness.

I have never seen this hare stand erect with its forepaws off the ground, as some of its smaller relatives are wont to do, and I doubt that it ever assumes this attitude except perhaps momentarily.

California Jack Rabbit.

(*Lepus californicus* Gray.)

The California Hare is one of the most easily recognized of the black-tailed rabbits which inhabit the United States. It is gray above, often tinged with brownish and mixed with black; the lower surface of the body and tail is buff. From the tip of the nose to the end of the tail vertebræ it measures about 23¼ inches (592 mm.). The ears vary from 5 to 6 inches (130–150 mm.), while the tail is only about 4 inches (102 mm.) in length.[1] The only other species which is likely to be confused with it is the Texan Jack Rabbit (*Lepus texianus*), which is also found west of the Sierra Nevada, in the San Joaquin Valley. But while individuals of both species show considerable variation in color according to season, the California Hare is browner and darker above, and the lower surface of the body and tail is buff or tan color, instead of white, as in the Texan species. Both are about the same size, but the tail in the California Jack Rabbit averages about an inch (25 mm.) longer.

Nowhere in the United States, and perhaps nowhere in the world, except in Australia, are rabbits so abundant as in some parts of California, but the published data respecting the distribution of the several species is a good illustration of how much still remains to be learned about even the commonest animals. The California Jack Rabbit was described in 1837, the same year in which the Prairie Hare was named, and the Texan species was first made known in 1848. Although all three of these rabbits have been frequently collected for nearly half a century, and all have been known to occur in California, it is only recently that the limits of their ranges have been accurately determined.

Hitherto it has been the custom to refer all the large black-tailed rabbits found west of the Sierra Nevada to the California species (*Lepus californicus*); but the Death Valley expedition sent out by the Department of Agriculture established the fact that the one best known, on account of its extraordinary abundance, in the lower San Joaquin Valley is not the California Jack Rabbit, but the widely distributed Texan species which occurs in the bottom of the valley from the Tejon Mountains north almost to latitude 38°.

[1] Average of 10 specimens from northern California.

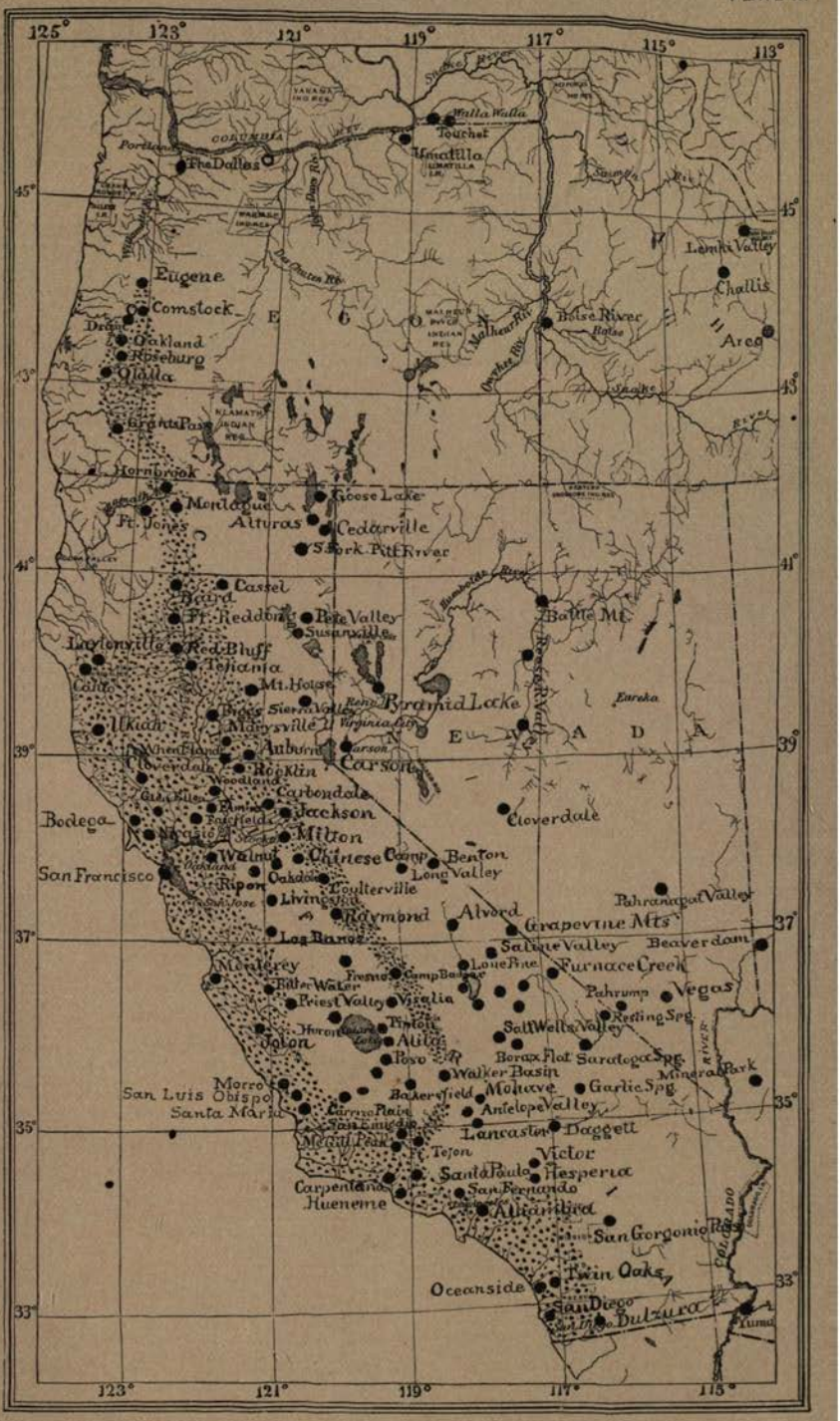
The true California animal was formerly supposed to extend eastward to the Colorado River and Arizona, but more recent investigations show that it is restricted entirely to the region west of the Sierra. Here, where the chaparral-covered slopes of the foothills dip down to the valleys, it is most at home, mainly below an altitude of 3,000 feet. Rarely does it range above 5,000 feet, although in one instance at least, on Mount Piños, it has been found higher than 8,000 feet. But the individuals found at these higher levels are few in number, and are probably only stragglers which have wandered up from the lower foothills. It avoids the dark, damp forests of the redwood belt on the Northwest coast; but finding suitable localities beyond the limits of its native State, it has crossed the Siskiyou Mountains and taken possession of the Rogue River and Umpqua valleys in Oregon, and is known to range as far north as Comstock, in Douglas County. Mr. Clark P. Streator reports that a single specimen, probably a straggler, was killed near Eugene, at the head of the Willamette Valley, about November 20, 1893. To the south this species extends some distance down the peninsula of Lower California.

While the limits of certain portions of this range are readily understood from well-marked conditions of climate and topography, it is by no means easy to explain the invisible but apparently sharply defined lines which separate the California and Texan rabbits in the great interior valley of California. Here they probably mingle with one another, but at no point are their habitats known to overlap to any great extent. Nor is it clear why the Texan Jack Rabbit, which extends up the east slope of the Sierra as high as 7,000 feet and over Walker pass (altitude 5,300 feet), should occupy only the bottom of the San Joaquin Valley below 2,000 feet. This part of its range is inclosed on both sides by that of *Lepus californicus*, which is here restricted to the foothills, but which spreads out to the north and covers the whole expanse of the Sacramento Valley, as well as the slopes of the Sierra Nevada and Coast Ranges. Briefly stated, the white-bellied species is found in the bottom of the San Joaquin Valley, while the buff-bellied animal occupies the Sacramento Valley and the adjacent foothills, as well as those surrounding the San Joaquin Plains.

The California Jack Rabbit is nowhere as abundant as the Texan species. In some portions of the Coast Range only two or three individuals will be found over a large extent of country, and it is quite rare in some of the valleys southeast of San Franciso Bay; but this is due mainly to the settlement of the country, and the various means adopted for its extermination. It is perhaps most abundant in the Rogue River Valley, Oregon, along the western slope of the central part of the Sierra Nevada, and in the San Gabriel and San Bernardino valleys.

In speaking of the California species T. S. Van Dyke[1] says: "Few animals are more graceful than this hare, whether skimming the

[1]Southern California, 1886, p. 131.



DISTRIBUTION OF CALIFORNIA AND TEXAN JACK RABBITS.

Dotted area = California Jack Rabbit; spots outside this area show where the Texan Rabbit has been collected.

plain before the outstretched greyhound or aroused from his 'form' he dashes away with high jumps, as if to take a better view of the intruder, or stopping and rearing upon his hind legs, stands erect, with ears pointed at the zenith and surveys him at safe distance, then again lengthens out his trim form and hugs the ground like a racer until a mile away. Sometimes at early morning or evening you may see him scudding along the plain as if in play, running 2 or 3 miles, perhaps, most of the time at high speed. * * * A fine runner he is, too, and gifted with good staying qualities. It takes a good greyhound to overtake the best of them, while the slowest ones distance a common dog at every bound."

Black-tailed Jack Rabbit, Texan Jack Rabbit.

(*Lepus texianus* Waterhouse.[1])

This hare is pale-gray above, often tinged with brownish and mixed with black; the lower surface of the body and tail is white, while the tips of the ears and upper part of the tail are distinctly marked with black. In length it measures about 25½ inches (647 mm.[2]) from the tip of the nose to the end of the tail vertebræ and weighs 4 or 5 pounds. The ears average 6¾ inches (171 mm.) but the tail is only 4¼ inches (109 mm.) in length. The Black-tailed Hare is smaller than either the Prairie Hare or Allen's Hare, but is about the same size as the California Jack Rabbit. Specimens from southern Arizona are not as large as those from the central part of the Territory and other portions of the Great Basin region, and for this reason have been recently separated by Dr. J. A. Allen[3] as a subspecies or race called the Desert Hare (*Lepus texianus eremicus*).

Usually it is not difficult to distinguish the Black-tailed Hare from other species found in the same region. In the northern parts of its range it occurs along with the Prairie Hare in some parts of Oregon, Washington, Idaho, Colorado, Nebraska, and Kansas, but here the latter (*Lepus campestris*) may be recognized by its white tail, larger size, and more or less complete change of pelage in winter—no black-tailed species showing any tendency to turn white in winter.

The Texan Rabbit will hardly be confused with the larger and longer limbed Allen's Hare in southern Arizona, after they have once been seen together, but it is sometimes difficult to distinguish it from the California Jack. Although typical specimens of the latter are buff instead of white below and have the lower surface of the tail buff, those from the foothills bordering the San Joaquin Valley in California are

[1]Under this name are included all the black-tailed jack rabbits, except *Lepus alleni*, which are found from the Rocky Mountains west to the Sierra Nevada and Cascade Range.

[2]Average of 9 specimens collected by Dr. E. A. Mearns at Fort Verde, Ariz. (Bull. Am. Mus. Nat Hist., II, Feb. 1890, 302.)

[3]Ibid., VI, Dec. 20, 1894, pp. 347–348.

frequently so light in color as to closely resemble the white-bellied Texan Rabbit.

The Black-tailed Jack Rabbit is found in the Great Basin from the Rocky Mountains west to the Cascade Range in Oregon and to the Sierra Nevada in California, and from central Idaho and southeastern Washington south to Mexico. Its range extends eastward into western Texas and some distance down the Rio Grande. West of the Sierra it has a most remarkable distribution in a narrow strip along the bottom of the San Joaquin Valley from the Tejon Mountains nearly as far north as latitude 38°. It gains access to the valley from the Mohave Desert by way of Walker Pass (altitude 5,300 feet) and probably also by the Cañada de las Uvas (altitude 4,300 feet). It is distinctly an animal of the deserts and plains and nowhere ascends to very high altitudes.

In southern Arizona and on the Colorado Desert in California the Texan Jack Rabbit is usually seen singly or in groups of only two or three individuals, while in Kansas, eastern Colorado, and some portions of the Great Basin large numbers are often found together. Its abundance or scarcity is usually governed by local conditions—an unusually cold winter, an epidemic or a dry year in which food is scarce, may so reduce its numbers as to make the species appear rare where ordinarily it is abundant. When food supply or other conditions favor its increase it is gregarious to a high degree, and occurs in immense numbers.

Forty years ago Dr. George Suckley found these rabbits very abundant south of the Boise River, on his trip through southwestern Idaho, in September, 1854.[1] He says: "They are so numerous that our command of 60 men subsisted on them for nearly a week. In a short ride of an hour's duration to see 30 near the trail was nothing remarkable. * * * This hare breeds in great numbers on the vast sage plains at the South Boise River, between it and the Snake River."

More recently, in 1878, Maj. Chas. Bendire found them in immense numbers in the Payette Valley, in southwestern Idaho, where fully 150 were seen together one morning near Payette River Ferry. At this point there was a small grass-covered island to which the rabbits could cross from the river bank by a bridge. When startled they merely loped away for a few yards and then stopped to ascertain the cause of the disturbance. A writer in 'Forest and Stream'[2] states that in the vicinity of Austin, Nev., jack rabbits are exceedingly abundant, and that 487 had been killed in eight hours by a party of 12 hunters.

But the Texan Jack Rabbit is most abundant in the southern part of the San Joaquin Valley from latitude 37° southward, where the conditions for its existence are so favorable that it is still able to hold its ground in spite of the great numbers annually slaughtered by drives.

[1] Pacific Railroad Reports, XII, Book 2, 1860, Chap. II, p. 105.

[2] Vol. XVIII, Apr. 20, 1882, p. 229.

In the summer of 1891 I saw large numbers just south of the town of Bakersfield. At least a hundred were in sight at once, and were so tame that they paid little attention to teams passing along the road, and would allow a person to approach within a few feet before moving. Dr. A. K. Fisher and Mr. Vernon Bailey also saw thousands of jack rabbits between Bakersfield and Visalia only a few weeks later. At one point just north of Delano, Tulare County, at least 100 scampered away at a single discharge of a gun.

Referring to the habits of the Black-tailed Jack Rabbit in Arizona, Dr. Coues[1] writes:

> At Fort Whipple, the species is very common the year round, and almost every sort of locality is frequented by them, though they chiefly affect grassy meadows and open glades, interspersed with copses, or clumps of oak trees, or patches of briery undergrowth. The gulches, or 'washes,' as they are called, leading out of mountain ravines, and thickly set with grease-wood (*Obione* [*Atriplex*] *canescens*), are favorite resorts. They feed much upon this plant, and by their incessant coursings through patches of it they wear little intersecting avenues, along which they ramble at their leisure. When feeding at their ease, and unsuspicious of danger, they move with a sort of lazy abandon, performing a succession of careless leaps, now nibbling the shrubs overhead, now the grass at their feet. They are *not at all gregarious*, though peculiar attractions may bring many together in the same spot. They do not burrow, but construct a 'form' in which they squat. I do not think these are permanent; but rather that they are extemporized, as wanted, in some convenient bush; though the case may be different during the season of reproduction. It has been stated by some authors, that only two or three are produced at a birth, which I know to be at least not always the case, having found as many as six embryos in the multipartite womb of a pregnant female. In the latitude of Fort Whipple the young are brought forth in June.
>
> * * * It has a long, swinging gallop, and performs prodigious leaps, some of them over bushes 4 feet high; now in the air, its feet all drawn together and downstretched; now on the ground, which it touches and rebounds from with marvelous elasticity. It will course thus for a hundred yards or so, and then stop as suddenly as it started; and, sitting erect, its long, wide open ears, vibrating with excitement, are turned in every direction to catch the sound of following danger.

Black-eared Jack Rabbit or Eastern Jackass Hare

(*Lepus melanotis* Mearns.)

The Black-eared Jack Rabbit is simply the eastern form of the Black-tailed Rabbit of the Great Basin region, and was described only six years ago, in 1890, by Dr. E. A. Mearns, from a market specimen supposed to have been killed near Independence, Kans.[2] The differences between it and the common Black-tailed Jack Rabbit are only apparent after a careful comparison of a series of specimens, but *Lepus melanotis* is described as having a richer coloring and shorter ears than its West-

[1] Am. Nat., I, Dec., 1867, pp. 532–533.

[2] Bull. Am. Mus. Nat. Hist., N. Y., II, Feb., 1890, pp. 297–300. The average measurements of two specimens from Independence, including the type, are: Total length, 23¼ inches (590^{mm}); tail, 3 inches (77^{mm}); ear, 5½ inches (142^{mm}). The ear averages nearly 30^{mm} shorter than in *L. texianus*.

ern representative. Whether it should be recognized as a full species or merely a subspecies need not be considered here; but it may be explained that under this name are included all the black-tailed jack rabbits occurring east of the Rocky Mountains and from central Texas northward to Nebraska.

This hare is found on the Great Plains from eastern Kansas to the Rocky Mountains and western Texas, where its range probably merges into that of *Lepus texianus*. In some parts of Kansas and in southeastern Colorado it is very abundant and is killed in large numbers. When full grown it weighs about 6 pounds and is the black-tailed rabbit most commonly seen in the markets of Eastern cities.

Its habits are similar to those of other jack rabbits. According to Mr. H. P. Attwater it is sometimes captured when young and kept alive, but is always wild and very pugnacious. It is much used in coursing, and is considered one of the best rabbits for this sport. An interesting experiment on its speed was made on the plains of eastern Colorado near Burlington, about 160 miles east of Denver.[1] Several hares were turned loose after having a drop or two of anise-seed oil rubbed on their feet, and as soon as they were out of sight a pack of five hounds was started in pursuit. The first and second hares were run down in about twenty minutes, but the hounds required nearly two hours to overhaul the third, 'an old black tail.' The writer adds that these rabbits run in circles as a rule. They make a spurt for the first two miles, but then begin to weaken, and if the scent is not lost they are certain to be overtaken by the hounds at last.

Allen's Jack Rabbit.

(*Lepus alleni* Mearns.)

Allen's Jack Rabbit is the largest and finest of the hares of the Southwest. Even at a distance it may be readily distinguished by its gray sides and the white on the hind part of the body. Its length is about 25¼ inches (643^{mm}); tail, 2¾ inches (69^{mm}); while the ears measure about 7¾ inches (195^{mm}).[2] The color above is yellowish brown mixed with black, but this area is restricted by the gray of the sides, and in autumn (November) specimens is a beautiful dark steel gray. This species was also described by Dr. E. A. Mearns, in 1890[3] from a specimen collected May 8, 1885, at Rillito Station, on the line of the Southern Pacific Railroad near Tucson, Ariz.

Allen's Hare is found in the deserts of southern Arizona and Sonora, in the region extending from Phœnix southeastward to the Santa Catalina and Santa Rita mountains, and thence south into Mexico almost as far as Guaymas. It has been collected in Sonora at Oputo, on the

[1] Am. Field, XLII, July 21, 1894, p. 53.

[2] Average of three specimens, including the type, collected by Dr. Mearns.

[3] Bull. Am. Mus. Nat. Hist., II, Feb. 1890, 294-297, 300.

upper Yaqui River, at Magdalena, Hermosillo, and Ortiz, and probably ranges over the greater part of the State. Little is known as to the western limits of its range, or the injury which it may do to crops when the country becomes more thickly settled. Concerning its habits Mr. W. W. Price says:

"This splendid hare is abundant about Tucson and in lower portions of the desert belt. It is found both on the gravelly hills bordering the Rillito at Fort Lowell, and on the immense mesquite and *Larrea* plains of Tucson. It is somewhat shy, and hard to secure, except with a rifle. One rarely comes upon it suddenly. I have never seen it start up with the quick, rapid flight of *L. texianus*. It has a slow, apparently awkward gait, but its leaps are long, and it gets over the ground with surprising rapidity. In color and habits it is so very different from any other American hare, the wonder is that it should have so long remained undescribed."[1]

[1] Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 201–202.

CHAPTER II.

ABUNDANCE AND RAPIDITY OF INCREASE.

It is well known that jack rabbits are very prolific, and reference has already been made to the great numbers found together in some parts of California, Idaho, Nevada, and South Dakota. Similar instances might be mentioned for southeastern Colorado and central Utah. But the best illustrations of extraordinary abundance in limited areas can perhaps be found in California. In Modoc County, in the northern part of the State, nearly 25,000 jack rabbits were said to have been killed in three months on a tract of land only 6 by 8 miles in extent; this was during the period when the bounty law was in force. A still more remarkable case has been recorded in the San Joaquin Valley. Some of the early drives near Bakersfield took place on a ranch less than 1 square mile in extent. In the first drive, on the afternoon of January 2, 1888, 1,126 rabbits were killed; as soon as the animals were dispatched, the same field was passed over again and 796 more killed. A week later, on January 10, there were two drives on the same ground, the first resulting in the destruction of 2,000 rabbits, the second in more than 3,000; in the latter an adjoining field was also driven over. It was estimated that altogether about 8,000 rabbits were killed on this ranch in nine days. The 'Kern County Echo' of March (8 ?), 1888, stated that a total of about 40,000 rabbits had been killed in the drives about Bakersfield from January 1, 1888, up to that date, and referred to an estimate that two-thirds of the rabbits killed in the drives were females and the average number of young of each of these was 3½. On this basis it was computed that had these 40,000 rabbits lived two months they would have increased to 135,000. When it is considered how much injury a single rabbit can do, the damage which such an army of rabbits is capable of inflicting would hardly be less than that caused by a grasshopper plague.

Surprise is sometimes expressed that jack rabbits are not entirely exterminated in regions where they have been mercilessly slaughtered for years, and it might be supposed that animals which live on the open plains without even the protection afforded by burrows or holes of any kind, could easily be kept within bounds, though they have comparatively few natural enemies. But experience has shown that this is no easy matter. Ada County, Idaho, which has been systematically killing off the jacks for fifteen years under the bounty system, received more scalps and expended more money for this purpose during 1895 than in any year since the bounty law first went into effect in 1878.

In view of these facts it may be worth while, before considering the subject of depredations or the methods used in extermination, to dwell somewhat on the way in which these rabbits contrive to hold their own under apparently great disadvantages and when exposed to attacks of every kind. Naturally their breeding habits and the rate at which the animals increase should be considered in this connection.

BREEDING HABITS.

The breeding habits of the Old World hare and rabbit are well known and have been determined repeatedly by observations on animals kept in confinement, so that the period of gestation, the number of young in a litter, the number of litters born in a year, and the age at which each species begins to breed are known with considerable accuracy. According to Sir Richard Owen, the period of gestation in the Old World hare (*Lepus timidus*) and the rabbit (*Lepus cuniculus*) varies from thirty to thirty-one days, and it is probably much the same in the case of our native species. The common European rabbit breeds from four to eight times a year and the number of young varies from 3 to 8 in each litter; it begins to breed when only 6 months old and attains an age of 7 or 8 years.[1]

The breeding habits of the various jack rabbits are so much alike that the account of those of any one species will serve as an illustration of the others. The following description is taken from Dr. Coues' paper on the Prairie Hare in Montana, to which reference has already been made:

> In the regions where I have studied this hare, the female brings forth in June and early July—oftener the latter—and apparently only one litter is produced each season. The number of young is 5 or 6, as a rule. The form is simply constructed, without burrowing, in the grass beneath some low, thick bush or tuft of weeds. The young are said to suckle and follow the mother for a month or more. They are agile little creatures, even when only a week or two old, and it is only when very young that they can be caught by hand. In traveling along the Milk River (where the species was abundant), early in July, I had several little ones brought to me, and some I kept for a time in a box. * * * Though only 5 or 6 inches long, they had all the motions and attitudes characteristic of the parents, and made shift to run about quite cleverly. They could not eat, but some of them could be coaxed to lick a little milk. (Bull. Essex Inst., VII, 1875, p. 81.)

Much still remains to be learned in regard to the number of young per annum, the exact time when they are born and particularly the number of litters per year. The interest in this subject is not restricted to the naturalist, for it is a matter of practical importance to the orchardist or the farmer to know when his efforts at extermination will be most effective.

Number of young in a litter.—Compared with the domesticated rabbit the jack rabbit does not increase very rapidly. Writers, however, differ widely concerning the number of young and the frequency with which the different species breed. Most of the statements seem to be

[1] Flower & Lydekker, Mammals Living and Extinct, 1891, p. 494.

largely matters of opinion. Mr. H. P. Attwater states that the jack rabbit on the southeastern coast of Texas is supposed to have only *one* young at a birth. Dr. J. H. Clark, surgeon of the Mexican Boundary Survey, notes that the species found along the Mexican border brings forth but 2 or 3 young at a time, and these usually late in the summer. The writer, in the 'Kern County Echo,' referred to above, says: "If these rabbits breed every six weeks, as is asserted by many, or at the outside, three times a year, * * * every farmer in this end of the valley without a rabbit-tight fence will be compelled to surrender his ranch to the pests."

As very little positive data seems to have been given by most observers, recourse was had to the specimens in the collections of Dr. C. Hart Merriam, the United States Department of Agriculture, and the American Museum of Natural History,[1] to supplement the few published notes. Altogether about 50 specimens were available for this purpose, consisting first of 15 adult females with young, which had been examined in the field and a note made of the number of embryos which each contained. These furnish the most accurate data possible concerning the number of young. The other specimens, 36 in number, comprise rabbits less than half grown, and in some cases only a few days old, which may be utilized to show roughly the dates of birth. The data thus collected are shown in the following tables:

Table showing number of Jack Rabbits in a litter (based on dissection of females with young).

Species.	Number of embryos.	Date.	Locality.
Lepus californicus	4	Mar. 19, 1894	Jolon, Cal.
Lepus campestris	4	May 5, 1890	Bridger Pass, Wyoming.
Do	4	May 30, 1894	Forks of Cheyenne, South Dakota.
Lepus melanotis (?)*	1	Dec. 28, 1894	San Antonio, Tex.
Lepus texianus	1	Jan. 24, 1891	Death Valley, Cal.
Do	6	Mar. 25, 1891	Do.
Do	6	Apr. 16, 1891	Panamint Mountains, Cal.
Do	4	May 1, 1891	Salt Wells Valley, Cal.
Do (?)	4	May 8, 1893	Raymond, Cal.
Do (?)	3	May 9, 1893	Do.
Do	2	May 25, 1892	Fort Huachuca, Ariz.
Do	6	June ? ——	Fort Whipple, Ariz. (Coues).
Do	3	July 9, 1890	Blackfoot, Idaho.
Do	3	July 31, 1891	25 miles west of Benton, Cal.
Do	2	Sept. 5, 1889	San Francisco Mountain, Arizona.

* Specimen in American Museum of Natural History, New York.

The number of young as shown by these 15 specimens varies from 1 to 6—never more; in fact it is probable that 6 is rather exceptional, although found in three of the cases mentioned above. The average obtained from the table is between 3 and 4 (3.5), but this result is probably not accurate. It will be noticed that all the cases of 3 young or

[1] Through the kindness of Dr. J. A. Allen, curator of mammals in the American Museum of Natural History, New York, I have had an opportunity of examining the jack rabbits in that collection.

less are in the desert region of the Great Basin or Arizona, or else represent second or third litters. Dr. E. A. Mearns, United States Army, who has examined many specimens in Arizona, states that it is very common to find only 1 young and that 2 is the usual number in that region. Farther north, however, both in the case of the Prairie Hare and the California Jack, 4 is probably not too high an average for the first litter, but it is doubtless true that later in the season the litters are smaller.

Time of birth.—The evidence at hand not only fails to substantiate the view that jack rabbits breed every six weeks in the year, but there is every reason to believe that each species has a regular breeding season and a definite period of rest. Certainly no data have been found which show that the young are born in the United States in October, November, or December. It is almost impossible to determine the exact dates of birth unless the animals are kept in captivity, but the time can be estimated approximately. As already stated, the period of gestation is about thirty days, so that the specimens mentioned in the last table can be utilized for this purpose by *adding* thirty days to the dates given and the results will be within a month, and probably within two or three weeks of the true time. Furthermore, it may be assumed that jack rabbits attain their full size (but not weight) in about two months, and the size of the adults and of the young at birth being known, the measurements of a young animal may be taken as a rough index of its age. The following table is based on an examination of 36 young rabbits selected for this purpose. No specimens were included which seemed to be much more than half grown, and nearly all those given may be assumed to be less than thirty days old and hence the date of birth less than a month earlier in each case.

The collection contains several specimens which illustrate the size and condition of the young at birth. Perhaps the most interesting are 4 fœtal Prairie Hares collected at Bridger Pass, Wyoming, May 5, 1890, evidently but a day or two before birth. The average measurements of these specimens are: Total length, 149^{mm}; hind foot, 36^{mm}. The animals are entirely covered with hair and the eyes are open. In one, at least, the front teeth (incisors) are cut, and nearly all the molars in the upper jaw are just breaking through the gums. The specimens having been preserved in alcohol for four years are somewhat shrunken and the total length is probably about 25^{mm} too short. A specimen of the Black-tailed Rabbit (*Lepus texianus*) from Panamint Valley, California, collected January 10, 1891—evidently only a few days old—measures only 192^{mm} in length, and hind foot 47^{mm}. Another of about the same age from Santa Rosalia, Chihuahua, taken September 21, 1893, measures 185^{mm}, hind foot, 43^{mm}. Thus, the young at birth average a little less than 200^{mm} in length; the hind foot about 40 or 45^{mm}. The dates of birth can be approximated from the following table with sufficient accuracy for present purposes by comparing the difference

between these measurements and those of any particular specimen with the difference obtained by subtracting the measurements of the young from those of the adult of that species.

List of young Jack Rabbits, showing time of birth.

Species.	Date.	Locality.	Total length.	Hind foot.	Remarks.
			Mm.	*Mm.*	
Lepus alleni	June 12, 1892	Riliito Creek, Arizona	455	110	Adult: Length 643mm; hind foot, 138.
Lepus californicus.	Mar. 18, 1892	San Fernando, Cal	375	105	
Do	Mar. 23, 1894	Jackson, Cal	405	104	
Do	Apr. 15, 1894	Oakdale, Cal	390	87	Adult: Length 592mm; hind foot, 136.
Do	Apr. 18, 1894	Chinese Camp, Cal	420	108	
Do	May 1, 1894	Priest Valley, Cal	410	116	
Lepus campestris	May 23, 1894	Newcastle, Wyo	344	95	
Do	May 24, 1894	do	350	99	
Do*	May 28, 1888	Fort Pierre, S. Dak	460	105	Adult: ‡ Length 598mm; hind foot, 150mm.
Do*	do	do	445	103	
Do*	Sept. 10, 1887	Fort Buford, N. Dak	265	.....	
Lepus melanotis†	Mar. 4, ——	San Antonio, Tex	.....	.....	One-third grown (?).
Do*	Mar. 9, 1891	Onaga, Kans	.....	.....	
Do†	Apr. 12, ——	San Antonio, Tex	266	73	
Do†	July 6, ——	do	.....	.....	Adult: Length 590mm; hind foot, 130.
Do	Apr. 26, 1894	Vernon, Tex	206	46	
Do	July 30, 1892	Cairo, Kans	405	109	
Do	Sept. 3, 1890	Onaga, Kans	.....	.....	
Do†	Sept. 17, ——	San Antonio, Tex	.....	.....	Unborn (?).
Do†	Sept. 17, ——	do	.....	.....	Do.
Do†	Oct. 11, ——	do	.....	.....	Few days old.
Lepus texianus	Jan. 10, 1891	Panamint Valley, Cal	192	47	
Do	Mar. 27, 1891	Grapevine Mountains, Nev	379	98	
Do	Apr. 10, 1891	Furnace Creek, Cal	200	51	
Do	Apr. 27, 1892	Fort Huachuca, Ariz	380	100	
Do	May 9, 1891	Beaverdam, Ariz	300	88	
Do	May 18, 1889	Phœnix, Ariz	410	102	Adult: Length 647mm; hind foot, 145.
Do	May 22, 1889	Carson, Nev	.....	109	
Do	June 11, 1891	Lone Pine, Cal	295	84	
Do	July 17, 1894	South Fork, Pitt River, Cal	281	77	
Do	July 26, 1890	Arco, Idaho	240	65	
Do	Sept. 21, 1893	Santa Rosalia, Chihuahua	185	43	
Lepus sp (?)	Jan. 23, 1892	Matagorda, Tex	260	80	
Do†	Sept. 30, 1893	Rockport, Tex	.....	.....	One-third grown (?).
Do	Aug. 14, 1892	San Luis Potosi, Mexico	195	48	
Do	do	do	198	48	

* In Merriam collection. † In American Museum of Natural History, New York.
‡ Average of 6 specimens from Wyoming.

It would have been desirable to have a much larger number of specimens, but the localities and seasons are well distributed and compensate in a measure for the small series. The earliest date of birth indicated in these tables is about the beginning of January in the case of three specimens—one taken in Panamint Valley, in the desert region of southern California, the others in southern Texas, at San Antonio and Matagorda. The latest dates (September), are represented by specimens from San Francisco Mountain, Ariz.; Santa Rosalia, Chihuahua, and Rockport and San Antonio, Tex. Between these extremes every month is represented, but most of the young seem to be born in April, May, and June. Specimens born after the 1st of July are from the northern part of the Plains, from the Great Basin, from southern Texas, from elevated regions, or from the table-land of Mexico. There is a noticeable absence of data from the low deserts of southern Arizona and southern California, apparently indicating at least a partial period of rest during the hot, dry summer. The tables also fail to show that

any jack rabbits are born before the 1st of February in California west of the Sierra, or before the 1st of April north of Kansas and central Nevada. The length of the breeding season in southern regions indicates that several litters are born each year, but in the northern United States the number is probably not more than two, or at the most, three.

The practical bearing of these generalizations is obvious. Drives or hunts organized for the extermination of rabbits should take place before the beginning of the breeding season, if they are to accomplish the desired end. Just after the young are born the rabbit population in a given place may be two or three times what it was six weeks previous, and the killing of 1,000 rabbits then would be only one-half or one-third as effective as the destruction of an equal number earlier in the season, when all the animals were adults. Drives in southern California should therefore be made in December, January, February, or early in March—the earlier the better, if the weather is favorable; later in the season more rabbits may be killed at one time, but a certain proportion will be young. In Colorado and Utah, hunts made before the 1st of February will accomplish much more than those in April, while in Idaho they may be postponed somewhat later.

Similarly, when killed for game, the rabbits from southern California or Arizona are not likely to be in the best condition after the 1st of February or March, while those from the northern Plains may be shipped up to the 1st of April. On the other hand, the young will hardly be in condition for market before October except in southern regions, and there the hot weather is likely to interfere with their shipment.

CHAPTER III.

INJURY TO CROPS AND MEANS OF PROTECTION.

INJURY TO GRAIN, ORCHARDS, ETC.

With the settlement of the West the jack rabbit has found that several cultivated crops furnish food which is better and more easily obtained than the wild plants on which it formerly fed, a fact that is too often demonstrated by the ravages committed in orchards and vineyards. Like the cottontail, it seldom ignores a neighboring alfalfa field or vegetable garden, and if unmolested can do a surprising amount of damage. Melons, cabbage, carrots, alfalfa, cotton, sweet-potato vines, young grain, grapevines, and trees suffer most frequently from its visits. The damage is most severe, however, in the young orchard set in newly broken ground, for here, deprived of its ordinary food by the cultivation of the land, the rabbit is forced to seek a new supply, and finds it in the tender bark of the young trees. A single animal can girdle a large number of trees in a short time, and will often injure them so seriously that part of the orchard has to be replanted. It destroys both the foliage and bark of young vines, but is especially partial to alfalfa and to cabbages. Fortunately, it does not burrow to any great extent, and therefore does not injure the roots of trees or plants, like the pocket gopher.

It has been estimated that five jack rabbits consume as much food as one sheep; thus some idea can be formed of the damage which a few rabbits may do in the course of a single night. Complaints of their ravages have been received from numerous correspondents from Texas to Washington, and from Kansas to California. Probably all the species are injurious, although no positive evidence against Allen's Rabbit is now at hand, simply because so little land in the area which it inhabits happens to be under cultivation. Most of the injury is done by the California Jack Rabbit and the wide-ranging Texan Hare (*Lepus texianus*).

Mr. H. P. Attwater states that jack rabbits are common in Aransas County, Tex., along the Gulf coast, and do so much damage that many of the smaller truck farms are protected by rabbit-proof fences. In the northern part of the same State Mr. W. J. Crowley, of Grapevine, Tarrant County, reports that they cause considerable injury to grain, and in fields of wheat, oats, and cotton often cut paths 12 inches wide and 300 or 400 yards in length, and destroy patches as large as an ordinary sized room. Mr. A. Vogt wrote from Willow Point, in the neighboring county of Wise, under date of December 6, 1889: "The damage done

to my old orchard of a thousand peach trees by rabbits [*Lepus sylvaticus* and *L. melanotis*] is 50 per cent. Three hundred trees are barked all around and below the bud, so that if they come out again they will be seedlings. Whitewashing the trunks does no good, as the rabbits take the whitewash and bark together."

When irrigation was first begun near Lamar, in southeastern Colorado, the rabbits were attracted from the surrounding country, and caused much damage in the alfalfa and young orchards. Hunts were arranged on a large scale to kill off the pests, and proved so successful that regular 'rabbit days' have been celebrated for the last two or three years at Las Animas and at Lamar.

In Idaho much difficulty has been experienced with jack rabbits at the experiment station at Nampa, Canyon County. They are particularly destructive to oats, wheat, barley, clover, vegetables, and fruit trees. Mr. T. T. Rutledge, assistant director, states that entire crops of grain and alfalfa are sometimes destroyed if small in acreage and unprotected.

Mr. J. B. Cure, of Rudy, Fremont County, writes under date of September 10, 1895: "Jack rabbits have done a great deal of damage in this part of the country to grain and lucern, and are increasing very fast. * * * Some of the farmers have lost from 8 to 10 acres of grain by rabbits this season."

Complaints have also been received from the State of Washington from Sunnyside, Yakima County; from Davenport, Lincoln County, and from Prescott, Wallawalla County. Mr. Conrod, of Davenport, wrote on December 19, 1887, that the jack rabbits were causing serious injury to grain, apple and plum trees, raspberry vines, carrots, and cabbage.

Mr. Oscar N. Wheeler, of Prescott, writing under date of August 12, 1895, says: "Jack rabbits (white tailed) have done a vast amount of damage to orchards, vineyards, and grain fields, but are not nearly so numerous now as they were three or four years ago, when they destroyed bearing orchards. Timber claims, planted in black locust that were large and old enough to 'prove up' on, were destroyed by them. People who had hay stacked had to fence it to keep them off. I have known large stacks of hay destroyed by them."

In Utah, Mr. W. G. Nowers wrote in February, 1887, concerning the Black-tailed Jack Rabbit (*Lepus texianus*) in Beaver County: "At times its ravages are enormous; sweeping down from the bench lands and sage plains in myriads, it devours entire fields of cereals. Last year in this and adjoining counties on either side its depredations amounted to several thousand dollars. Last year some farmers in this county lost their entire crop of small grain from this source alone. At Minersville not more than one-third of the crop was harvested; at Adamsville nearly the total crop was taken; at Greenville one-half of the crop was destroyed; and here (Beaver) about the same. This is also a fair representation of the ravages in Iron County south of us."

In California jack rabbits are most abundant on some of the richest lands in the State, and they have been particularly injurious to the vineyards and crops in the southern coast counties and in the San Joaquin Valley. The following account of their ravages in western Fresno County, by Mr. Alvah A. Eaton, gives some idea of the extraordinary numbers in the central part of the San Joaquin Valley, and shows how a scanty food supply drives the rabbits to the cultivated fields. Mr. Eaton says:

I arrived in Fresno, Cal., April 1, 1890, after what was known as a wet year, i. e., rain enough had fallen to sprout wheat and raise a fair crop without irrigation. These conditions were favorable for various 'tar' and 'alkali' weeds (species of *Madia*) which grew so luxuriantly that year that they prevented the heading of wheat in several sections of the Riverdale country. The next year was dry, and there was no wild feed that the rabbits could get, so they flocked to the wheat fields, feeding on the wheat and hiding and breeding in the weeds. Many were destroyed by burning the weeds, and by gunners, but it did not seem to make much difference. To make matters worse, there had been a bounty of $5 a scalp placed on coyotes, and these were mercilessly hunted, and the rabbits and squirrels throve in consequence.

During the summer of 1891 it was no uncommon thing to start 1,000 rabbits out of a patch of weeds, and in one patch about a quarter of a mile long there were at least 5,000. The winter of 1891–92 was also 'dry,' no feed springing up till late in February. The rabbits were driven by hunger to the alfalfa fields. They gnawed the tops of the stools to the roots, and even dug them out with their feet and ate them. One 10-acre field of my brother's was more thickly covered with their droppings than I ever saw a pasture covered with those of sheep.

Such was the state of affairs in the spring of 1892 just previous to the four great Fresno County 'drives,' which occurred in February and March, resulting in the destruction of more than 43,000 rabbits.

The damage which jack rabbits have done has been enormous, but it is very difficult to obtain reliable statistics. The 'Visalia Delta' of February 16, 1888, estimated that the annual loss in Tulare County amounted to more than $600,000. During the last six or seven years, however, owing to the increased acreage under cultivation and the vigor with which 'drives' have been conducted, the rabbits have been kept pretty well in check.

The loss on account of the depredations of rabbits in Victoria, Australia, for the ten years, 1878–1888, has been estimated at about $15,000,000 (£3,000,000).[1]

PROTECTION OF ORCHARDS AND CROPS.

The cost of properly protecting trees and vines is often a large item in the expense of setting a new orchard or vineyard. Several methods are commonly employed, but the one which is most effective, and the only one which can be used for crops of all kinds, is the rabbit-proof fence. Rabbits which succeed in getting into the inclosure may be shot or poisoned.

[1] Journ. Soc. Arts, London, XXXVII, No. 1879, Nov. 23, 1888, p. 22.

FENCES.

If the orchard or field is to be protected as a whole, it should be inclosed by a low fence so built as to leave no holes large enough to admit a rabbit. While the animals could easily leap over a low fence they are not likely to under ordinary circumstances.[1] In southern California experience has shown that a fence about 2 feet high affords ample protection under ordinary circumstances, and many vineyards and orchards are surrounded by lath fences 2 to 2½ feet in height. In the rabbit-infested region near Bakersfield, Cal., the fences are built somewhat higher than usual—about 5 feet—and are made of laths securely fastened with wire, which is stretched between posts set 15 or 20 feet apart (see corral in Pl. III, p. 47). Several kinds are in use, but in any case the fence should be built well down to the ground, and may be still further protected by running a barbed wire along the surface of the ground, or by turning a furrow against the bottom to prevent the animals from crawling under. A horizontal board fence may be rendered rabbit proof by nailing slats between the boards or by placing the lower boards closer together. Fencing material consisting of laths interwoven with wire is sold in large rolls and can be had in some localities ready for stringing to the posts. Woven wire fences are also made especially for keeping out rabbits. One of the best fences is made of galvanized wire netting with 1½-inch meshes stretched between posts which are set in the ground at convenient distances. The netting should be fastened with staples on the *inside* of the posts, and two barbed wires, with barbs 2½ inches apart, fastened to the *outside* of the posts, one just clearing the ground and the other an inch above the top of the netting. The barbed wires will tear any rabbit that tries to scratch under or jump over the fence. If desirable, a third wire may be stretched a foot or two above the top of the netting, which will make a fence high enough to keep out cattle.[2]

In regions having a heavy snowfall it may be necessary to build the fences somewhat higher, as the rabbits, taking advantage of the drifts, can oftentimes clear a low fence. This difficulty has been experienced in Idaho, and some orchardists have used a combination fence made of paling 4 feet high protected at the bottom outside by a strip of wire netting 2 feet in width. Ordinary fences made of laths or paling can not be relied on if wide spaces are left between the slats, as the rabbits can then gnaw a hole large enough to gain entrance to the inclosure. Prof. Charles P. Fox, director of the experiment station at Moscow, Idaho, suggests that such fences can be still further protected by dipping the slats in a warm solution of silicate of soda or protecting them

[1] It may be interesting to note that a jack rabbit has been seen to clear a 7-foot fence at a single leap. Mr. Charles Payne, of Wichita, Kans., had several animals confined in an inclosure of this height and actually saw one or more escape by jumping over the fence. (Am. Field, XLII, Sept. 29, 1894, p. 295.)

[2] Wickson, California Fruits, 1889, p. 553; 2d ed., 1891, p. 577.

with sand paint. He also reports that a substitute for fencing is now being tried at the substation at Nampa, Idaho. Rabbits are very troublesome at this place, and in past years have destroyed almost the entire crop of alfalfa. Last spring, instead of building an expensive rabbit-proof fence, a band of alfalfa 30 feet in width was sowed around the field, which was inclosed simply with three strings of barbed wire, the idea being that jack rabbits, which usually feed around the edges of the field, will obtain sufficient food from the outside strip and not molest that within the fence. He says "we can grow rabbit feed in the form of alfalfa cheaper than anything else."

In Australia fences have proved the best means of protection, and many miles of rabbit fences have been built by the government. One fence, running from Narromine, on the Macquarie River, to Bourke, on the Darling River, and thence to Barringun, is 291 miles in length and cost on an average £82 per mile. It has recently been extended to Corowa, making the total length 703 miles. Another fence has been built from the Murray River northward along the western boundary of New South Wales for a distance of nearly 346 miles, at an average cost of a little over £75 per mile. These fences were built of 17-gauge wire netting 42 inches in width and having 1¼ or 1½ inch meshes. The fences are looked after by 'boundary riders,' who live in huts about 30 miles apart. Altogether the government has erected 1,049 miles of fencing in New South Wales, while the amount built by individuals has been estimated at about 15,000 miles.[1]

In Queensland about 675 miles of fences have been built by the government[2] and in New Zealand £12,530 have been expended for the South Canterbury fence.

PROTECTION OF SINGLE TREES.

Where the expense of a fence is too great, young trees may be protected by wrapping the stems with strips of burlap, gunny sacking, or coarse cloth an inch or two wide. These strips should be securely tied at the top and bottom. Small cylinders of wire netting, heavy pasteboard, or other material are sometimes used, and a device known as the 'tule-tree protector,' made of the dried rushes or tules, which grow so abundantly in the San Joaquin River swamps in California, has been patented for this express purpose. Recently cylinders made of thin strips of yucca wood (*Yucca arborescens*), with the edges fastened together by wire, have been placed on the market. They come in several sizes and are readily put in position. While they shield the stems from the sun their value in protecting the trees from jack rabbits is open to question.

SMEARS.

Some orchardists advocate painting the trunks of the trees with mixtures distasteful to rabbits. Whitewashing is said to prove effect-

[1] Coghlan, Wealth and Progress of New South Wales, 1894, Vol. I, p. 356.

[2] Year Book of Australia, 1894, p. 145.

ive in some cases, particularly if a mixture of glue and copperas is added to the solution. The mixture is made as follows: Take a bushel of unslaked lime and add sufficient water, then add two pounds of dissolved glue, and stir in thoroughly one pound of copperas. Another mixture which is said to work well consists of one pound of commercial aloes with four gallons of water. A tea made by steeping quassia chips is also used.[1] A combination of potash and clay is occasionally employed, and is mixed so as to have a consistency like that of thick cream. A writer in the 'American Garden' recommends rubbing the bark thoroughly with blood or grease, and asserts that rabbits will not touch trees that have been treated in this way. He adds: "In the case of trees which have been gnawed or peeled, the wound should be covered with a cloth on which is spread a little grafting wax. This not only excludes the air, but also helps the injured part to heal." The New Zealand department of agriculture has recently recommended a paint made of cow dung, clay, and soot and slightly flavored with tar or spirits of tar for protecting the stems of trees from rabbits.[2] Too much reliance should not be placed on smearing the trunks of trees, and no mixture should be used which contains petroleum in any form. Blood or grease will soon cease to be effective and it becomes necessary to repaint the trees in a short time.

[1] Wickson, *l. c.*, p. 553; 2d ed., p. 577.

[2] Leaflets for Gardeners, etc., No. 10, June, 1895, p. 8.

CHAPTER IV.

METHODS OF DESTRUCTION.

The destruction of rabbits has been so carefully investigated in Australia that it may be well to refer briefly to the conclusions arrived at by the Royal Commission which was appointed to inquire into schemes for the extermination of rabbits in Australasia. In a proclamation dated August 31, 1887, the government of New South Wales offered a reward of £25,000 for the effectual extermination of rabbits by any method or process not previously known in the colony, but three years later a report was made that "after prolonged and careful study of all the proposals which have been submitted, the commission finds that no scheme has been propounded for the extermination of rabbits which complies with the terms of the proclamation."[1]

INOCULATION.

The question of introducing infectious diseases was also carefully considered, but while the commission "found no evidence to warrant the belief that any known disease can be so employed as to exterminate rabbits," it suggested that many diseases would probably be found useful auxiliaries in keeping the rabbit plague within manageable proportions.[2]

The success of disease as a means of destruction depends on two conditions: (1) It must be fatal to the rabbits; (2) it must not injure man or domesticated animals. The Australian experiments were mainly confined to the effects of (1) chicken cholera, (2) the so-called 'Tintinallogy disease,' (3) diseases caused by the bladder worm (*Cœnurus*), and (4) by rabbit scab (*Sarcoptes cuniculi*). It was found that while the rabbits were easily killed by putting microbes of chicken cholera in their food the disease did not spread freely from infected to healthy animals. The Tintinallogy disease takes its name from a station on the east bank of the Darling River near Menindie, New South Wales, where a peculiar affection was noticed among the rabbits in September 1887. The principal symptoms are erection of the fur, begin-

[1] New South Wales Roy. Comm. Inquiry Exterm. Rabbits in Australasia, Final Report, 1890, p. 11.

[2] L. c., p. 3.

ning on the head; slight discharge from the eyes and nose, lasting three or four days; emaciation, followed by loss of power in the hind legs, and finally death with convulsions in about three weeks. Experiments were made with this disease on a large scale, but were only partially successful. In addition to the bladder worm and rabbit scab, experiments have been made in New Zealand with rabbit measles (*Cysticercus pisiformis*) and liver coccidium (*Coccidium oviforme*). The latter parasite is injurious to man, and its introduction is therefore dangerous. Diseases caused by parasites do not offer much hope as a successful method of destroying rabbits, as their effects at best can be only indirect by bringing about a condition of general weakness and emaciation, and thereby rendering the animal more subject to attacks of other diseases. A full account of these experiments will be found in the report of Prof. A. P. W. Thomas on The Rabbit Nuisance in New Zealand, 1888, and the Report of the New South Wales Royal Commission on the Introduction of Contagious Diseases amongst Rabbits, Sydney, 1889.

Further inquiry into the epidemic and parasitic diseases of rabbits was advised by the New South Wales commission, and it may be added that this means of destruction seems to promise better success in this country, where large numbers of jack rabbits are destroyed every few years by epidemics.

METHODS USED IN AUSTRALIA.

No less than 1,456 persons submitted schemes to the Australian commission for the destruction of rabbits by methods other than disease. The various schemes were arranged under the following heads:[1]

1. Commercial utilization.
2. Fencing.
3. Poisons.
4. Natural enemies.
5. Traps.
6. Electricity.
7. Miscellaneous, including firing the country, cutting off from food and water, hunting and trapping parties, etc.
8. Indefinite methods.
9. General methods.
10. Methods involving special legislation.

A method which has been tried with some success in New South Wales, consists in capturing a number of rabbits alive and allowing the males to escape after killing all the females. As soon as the males begin to predominate in numbers, it is said that they persecute the females with their attentions to such an extent as to prevent them from breeding, and also kill the young that happen to be born.[2]

The Australian commissioners did not favor commercial utilization, because "the principle of making rabbits a profitable article of commerce is universally condemned by practical men interested in their destruction, on the ground that it leads to their conservation." This method, however, has recently been brought to notice and seems to be one of the most promising (see pp. 65–78).

[1] Final Report, 1890, pp. 3–4.

[2] Nature, XXXIX, March 21, 1889, pp. 493–494.

The question of fences has already been discussed under the head of prevention of injury to crops (pp. 33–34). Poisons, bounties, and natural enemies will be considered in detail further on. The other schemes were found to be either impracticable or unworthy of recommendation for use on a large scale.

The most successful traps used in New South Wales have been yards or inclosures made of rabbit-proof fence with openings which allow the rabbits to enter but prevent their getting out. Such traps have been found most efficient in dry seasons, when food and water are scarce. Several methods of using electricity were submitted, but all were found impracticable. Firing might be employed in some cases, but is attended with more or less danger. Cutting off the animals from food can only be used under certain favorable conditions.

Hunting and trapping parties have not accomplished much in Australia, but in certain parts of the United States a modification of this method has proved to be the most successful means of destroying large numbers of jack rabbits. (See chapter on rabbit drives, pp. 47–64.)

POISON.

In this country poison has been used to some extent, although less successfully than the gun and club. As none of the jack rabbits burrow, the poison must be scattered about on the surface of the ground where the rabbits are likely to find it, but the bait should not be placed where domesticated animals or poultry can eat it. Promiscuous scattering of poison in the orchard and vineyard is not to be recommended under ordinary circumstances, and when it can not be placed in holes or out of the reach of animals for which it was not intended the danger is greatly increased. The importance of this fact can hardly be overestimated, and every possible precaution should be taken in using poison for jack rabbits. In Australia experiments have been made with strychnine, phosphorus, arsenic, corrosive sublimate, lead salts, tartar emetic, barium carbonate, and sulphate of iron. Arsenic may be simply sprinkled on any food which will attract the rabbits, but it is more effectual when dissolved and the bait soaked in the solution. Paris green, London purple, lead salts, tartar emetic, barium carbonate, and sulphate of iron have not been found sufficiently active for killing rabbits, and corrosive sublimate has a powerful acrid and metallic taste, which may render it unpalatable to them.

Of all the poisons mentioned above, strychnine is the most effective. As the ordinary crystals of strychnine are almost insoluble in water, the sulphate should be used when the poison is to be dissolved. It may be placed on bits of watermelon, cantaloupe, or vegetables of which the rabbits are fond, and scattered around the orchard or vineyard. Rabbits are said to be attracted by a mixture composed of half a teaspoonful of powdered strychnine, two teaspoonfuls of fine salt, and four of granulated sugar, thoroughly shaken up and placed in small

piles on a board.[1] Dr. John Strentzel, of Martinez, Cal., recommends mixing the strychnine with grain which has been well sweetened with oil of anise or rhodium and placing it where it will be readily found by the animals. Mr. A. Plumley, of Byron, Cal., uses dry pulverized strychnine with wheat or barley that has been soaked in water and slightly warmed. Sugar and flour are added in suitable quantities and the poison carefully mixed with the grain and spread out to dry. The addition of sugar and flour makes the strychnine adhere to the grain, and the mixture is reported highly successful. Maj. G. F. Merriam, of Twin Oaks, Cal., recommends soaking the wheat in water containing strychnine. The wheat is barely covered with water and allowed to soak until the grain is soft, and then dried as thoroughly and quickly as possible. A handful of this dry wheat is placed among the vines or scattered in the trails made by the rabbits.

Phosphorus is advocated by many persons, but it must be thoroughly soaked into the grain; if simply deposited on the outside and not covered with some protective material it will oxidize rapidly. Wheat soaked in water containing phosphorus is highly recommended. It should be used in the following proportion: One hundred pounds of grain, 1 pound of phosphorus, 1 pound of sugar, 1 ounce of oil of rhodium to 9 gallons of water. The mixture should be heated to the boiling point and allowed to stand over night, then enough flour added to make it a paste.[1]

In Australia preparations of phosphorus have been more generally used. A writer in the 'Kyneton Guardian' gives the following directions for preparing the poison: Four and one-half ounces of phosphorus are put into a gallon of boiling water and kept boiling for thirty minutes, while the phosphorus is thoroughly stirred. The liquid should be passed through a fine strainer. Fourteen or 15 pounds of malt are then stirred in and allowed to boil slowly for fifteen minutes, and finally 3 pounds of flour and 4 pounds of sugar are added. The mixture is sown like turnip seed, in furrows plowed here and there in rabbit-infested places.

Another method of preparing phosphorus, known as the 'Lascelles process,' "consists in (1) dissolving the phosphorus in bisulphide of carbon, (2) mixing the solution so obtained in a churn with flour paste so as to form an emulsion, and (3) coating the wheat in a revolving cylinder with this emulsion. The solution of phosphorus is made and kept under water, so as to prevent spontaneous combustion. This method has the advantages of facility and quickness, of the even distribution of the poison over the grain, and also of the prevention of volatilization by the coating with flour paste."[2]

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[1] Wickson, California Fruits, 1889, p. 554; 2d ed., 1891, p. 578.

[2] Final Report, Royal Comm. Inquiry into Schemes Exterm. Rabbits Australasia, 1890, p. 6.

BOUNTIES.

Bounties have been paid on jack rabbits in five of the Western States—California, Idaho, Oregon, Texas, and Utah—but the amounts have been small as compared with similar expenditures for the destruction of other animals. In Oregon, Texas, and Utah the rates were fixed by State laws, but in California the bounties varied in different counties. Bounties on rabbits have been even less successful, so far as extermination is concerned, than those offered for coyotes, prairie dogs, pocket gophers, or ground squirrels.

CALIFORNIA.

One the main objects of bounties in California, particularly those offered by the counties in the San Joaquin Valley, was to encourage rabbit drives, and in some cases the payments were almost sufficient to defray such expenses. Eight counties have offered bounties during recent years, namely, Butte, Colusa, Fresno, Modoc, San Bernardino, Shasta, Sutter, and Tulare. In the case of Sutter County, and possibly one or two others, the returns include amounts expended for pocket gophers and ground squirrels. Bounties are seldom offered on rabbits alone, and it is difficult to obtain the amounts expended for each species.

A rate of 10 cents per scalp was paid both by Butte and Colusa counties—the highest rate paid for any considerable length of time. In Butte County it was maintained from January 7, 1887, to February 1, 1890; in Colusa, from February 10, 1888, to September 12, 1892. The bounty was then reduced to 4 cents and continued to February 1, 1894.

In Fresno the bounty was offered merely to defray the expenses of the rabbit drives, and was not paid unless at least 1,000 pairs of ears were presented at one time. The total amount expended was about $500, indicating that more than 33,000 scalps were received.

In the spring of 1886 the supervisors of Modoc County offered 3 cents apiece for rabbit scalps, and in three months expended $826.77 for 27,559 scalps.[1]

The bounty offered by San Bernardino County about two years after the passage of the coyote scalp act of 1891, is unique from the fact that its main object was to offset the effect of the State bounty on coyotes. The ordinance went into effect August 25, 1893, and expired by limitation on December 6 of the same year. It provided that the rabbits must be killed within 2 miles of a cultivated orchard, nursery, vineyard, or alfalfa field not less than 1 acre in extent, and the scalps must be deposited within thirty days with a justice of the peace of the township in which the animals were killed.

Tulare County expended $5,000 for bounties on ground squirrels previous to November 1894, besides paying $3,000 for bounties on rab-

[1] Forest and Stream, XXVII, August 5, 1886, p. 26.

bits. The 'Los Angeles Times' states that no less than 4,000 scalps were secured in the drive near Traver, March 6, 1892, and as many as 5,391 have been deposited by a single person at one time. The ordinance under which these bounties were paid will serve as an illustration of those in other counties. It was passed October 31, 1891, and reads as follows:

ORDINANCE No. 46.

The board of supervisors of the County of Tulare, State of California, do ordain as follows:

SECTION 1. [Provides for a bounty of 2½ cents on ground squirrel scalps.]

SEC. 2. That a bounty of one and one-half ($0.01½) cents be paid by this county on each and every scalp taken from a jack rabbit, containing both ears of said dead animal, killed or destroyed by any person or persons in this county, upon the said person or persons so killing or destroying said animal depositing said scalp or scalps with any notary public, justice of the peace, or any officer authorized by law to take affidavits, and certify claim with said affidavit, together with affidavit of such officer that said scalp or scalps have been destroyed by fire to this board.

SEC. 3. That said bounty shall be paid by the county until such time when the funds set apart for that purpose shall be exhausted, or until this ordinance be repealed or rescinded by this board.

SEC. 4. That this ordinance take effect and be in force from and after the 31st day of October, 1891.

SEC. 5. [Provides for publication of the ordinance.]

So far as figures are available, the amount expended in California is about $16,000, although no returns have been received from San Bernardino County. The amounts disbursed are shown below:

Table showing expenditures for Bounties by Counties in California.

County.	Bounty in force.	Number of scalps.	Rate per scalp.	Amount expended.
			Cents.	
Butte	Jan. 7, 1887, to Feb. 1, 1890	* 35,000	10	$3,500.00
Colusa	Feb. 10, 1888, to Sept. 12, 1892		10	4,800.00
	Sept. 12, 1892, to Feb. 1, 1894		4	
Fresno		* 33,000	1½	500.00
Modoc	Three months, 1886	27,559	3	826.77
San Bernardino	Aug. 25 to Dec. 6, 1893		20	
Shasta	May 11, 1891, to Mar. 1, 1892		5	342.55
Sutter	Sept. 25, 1893, to July 9, 1894		8	† 3,040.42
Tulare	Oct. 31, 1891, to Nov., 1894†	* 200,000	1½	3,000.00

* Estimated from amounts expended.
† Includes also bounties on gophers and ground squirrels, at 5 cents per scalp.

IDAHO.

Two counties in Idaho—Ada and Canyon—are now paying bounties on jack rabbits at the rate of 3 cents per scalp. Mr. Charles S. Kingsley, county clerk, has kindly supplied the figures for the expenditures in Ada County, and wrote, under date of August 24, 1895, as follows:

"The county began the payment of bounty July, 1878, and from that time until October, 1886, paid $8,129.75; from the latter date to the

8th day of July, 1895, the county paid the sum of $22,963.69, making an aggregate of $31,093.44.

"I have myself been much interested in these figures, and find that during the 33 quarters embraced in the first period stated the average quarterly amount was $232.27, while during the 35 quarters embraced in the last period the average quarterly payment amounted to $850.50. It is noteworthy that during 1887 (latter part), 1888, 1889, and part of 1890 the average quarterly payments dropped to approximately $100. This was due to the very great destruction of rabbits during the winter of 1887 by extreme cold. It is thus seen that the average has been growing larger, notwithstanding the bounty, and the figures for the last quarter are $2,520.65; that, with the current quarter, are of course the heavy quarters of the year, and it is possible the total average per quarter for the year [1895] will not exceed $1,000. These figures seem to indicate that the bounty is not a success in the matter of exterminating the pests,"—and yet at the rate of 3 cents apiece more than 1,000,000 rabbits must have been destroyed.

OREGON.

Under the session laws of Oregon, 1887, a bounty varying from 1 to 5 cents was offered for jack rabbits. The law specially stated that this bounty was to be paid for the Black-tailed Rabbit, and none seems to have been paid on the Plains Jack Rabbit (*Lepus campestris*), which occurs in the same region. During the years 1888, 1889, and 1890, Lake County paid bounties on 54,000 rabbit scalps at the rate of 4 cents each, amounting in all to $2,160.

TEXAS.

In April, 1891, the legislature of Texas passed "An act to protect stock raisers, farmers, and horticulturists," which provided—

> That hereafter when any person shall kill any wolf, either coyote or lobo, panther, Mexican lion, tiger, leopard, wild-cat, catamount, or jack rabbit, he shall be paid in the county in which he kills such animal or animals the sum of two dollars for each coyote, and the sum of one dollar for each wild-cat or catamount, and the sum of five dollars for each panther, lobo, Mexican lion, tiger, or leopard, and the sum of one dollar per dozen for jack rabbits, and fifty cents per dozen for prairie dogs so killed.[1]

The sum of $50,000 was appropriated and expended in carrying out the provisions of this law. Unfortunately it has not been possible to obtain the amounts paid for each of the animals named, so that the total bounty on jack rabbits can not be stated. The burden of this expenditure fell so heavily on some of the southwestern counties of the State that the law was repealed in March, 1895, and a new act substituted which made the payment of bounties optional with the counties, and omitted jack rabbits and prairie dogs from the list of proscribed animals.

[1] General Laws of the State of Texas, 22d legislature, 1891, p. 160, chap. 100, sec. 1.

UTAH.

Section 2114 of the laws of Utah for 1890 authorized the county courts to offer bounties for the destruction of jack rabbits and certain other injurious animals. On September 1, 1893, a bounty of 5 cents per scalp was placed on rabbits by the court of Boxelder County. This rate was maintained until January 28, 1895, when it was reduced to 2 cents per scalp. The county clerk reports that up to December 31, 1895, bounties had been paid on 111 coyotes at 50 cents each, while more than $500 had been expended for rabbits, as follows:

Table showing expenditures for Bounties in Utah.

County.	Date.	Number of scalps.	Rate per scalp.	Amount expended.
			Cents.	
Boxelder	Jan. 1–Sept 1, 1893	716	2	$14.32
Do	Sept. 1, 1893–Jan. 28, 1895	9,179	5	458.95
Do	Jan. 28–Dec. 31, 1895	2,863	2	57.26
Total		12,758		$530.53

Bounties represent the only expenditures made by counties or States in this country for the destruction of rabbits. As shown above, the totals, including the State bounty of Texas, which was paid on several other species of animals, aggregate about $100,000, an amount which is insignificent when compared with that spent in Australia.

EXPENDITURES IN AUSTRALIA.

The common rabbit of Europe (*Lepus cuniculus*) was introduced into Australia about the year 1864 at Barwon Park, near Geelong, Victoria.[1] In the course of a few years it spread over Victoria and westward into South Australia, crossing the Murray River in 1878. The following year legislative action for the destruction of the pest was inaugurated by South Australia, and the example was soon followed by Victoria, New South Wales, New Zealand, Queensland, and Tasmania. No less than 19,182,539 rabbits were destroyed in New South Wales alone in 1887.[2] But in addition to the direct payment of bounties, the governments of the colonies have expended large sums for poisons, for experiments on various methods of destruction, and have built several thousand miles of rabbit-proof fences. As shown by the following table, the total amount expended up to 1888 was £1,093,890 (more than $5,000,000) in addition to £96,264 (nearly $500,000) for fences.

[1] According to Hon. James M. Morgan, formerly United States consul-general at Melbourne, rabbits were first introduced in western Victoria about 1860, for the purpose of sport. (Consular Reports for Dec., 1886, XX, p. 482.)

[2] Circular on Rabbit Destruction. Committee New South Wales Comm. Pastoral and Agr. Ass., Jan., 1888.

*Government Expenditures for Destruction of Rabbits in Australia and New Zealand, 1879–1888.**

Colony.	Date.	Amount.	Remarks.
New South Wales	1883–1888	† £732,236	£23,997 also expended for fences.
Queensland	Up to Dec., 1887	(‡)	£59,737 for fences.
South Australia	1881–1888	128,595	
Victoria	1879–1888	131,724	On unoccupied Crown lands.
New Zealand	1882–1888	18,453	£12,530 also expended for South Canterbury fence.
Tasmania	May, 1883–Jan., 1888	82,882	
Total		1,093,890	Add £96,264 for fences.

* Progress Rept. New South Wales Royal Com. Inquiry Exterm. Rabbits, 1890, App. II. pp. 190–192.
† Hon. J. H. Carruthers, Minister for Lands, gives £831,457 4s. 1d., as the total amount expended from the passage of the rabbit act in 1883 to June 30, 1890. The figures for each year are less in nearly every case than in the statement quoted above, but represent the sums disbursed "solely for the purpose of attempting to get rid of the rabbit." From July 1, 1890, to December 31, 1894, the expenditure amounted to only £22,761, which was devoted to fences. (Rept. Conference Rabbit Pest in New South Wales, 1895, p. 6.)
‡ Total expenditures up to 1894 (largely for fences), £136,484 8s. (Year Book Australia for 1894, p. 145.)

NATURAL ENEMIES OF JACK RABBITS.

Birds of prey seldom molest the larger hares. Among those which are known to feed on jack rabbits are the barn owl (*Strix pratincola*), Audubon's caracara (*Polyborus cheriway*), prairie falcon (*Falco mexicanus*), and western red-tailed hawk; but remains of the Texan rabbit have been found in the stomach of the red-tail in only three cases among a large number examined. The western horned owl (*Bubo virginianus subarcticus*) and the golden eagle (*Aquila chrysætos*) should also be mentioned. The marsh hawk (*Circus hudsonius*) occasionally attacks rabbits, and Mr. J. Alden Loring shot one at Vernon, Tex., while in the act of killing a young jack rabbit which weighed a pound and a half.

The mammals in this list are likewise few in number, the most important being the coyote (*Canis latrans*), gray wolf (*Canis nubilus*), long-eared fox (*Vulpes macrotis*), gray fox (*Urocyon*), and wild-cat (*Lynx*). Skunks, weasels, and badgers may occasionally destroy the young, but seldom, if ever, the full-grown hares. The badger, an indefatigable hunter of the ground squirrel and the prairie dog, is too slow of foot to overtake the jack rabbit in a fair race, and is unable to corner him in a hole, as he can a burrowing animal.

On the Great Plains the gray wolf undoubtedly destroys large numbers of jack rabbits in the region from Colorado northward. In Montana, according to Dr. George Bird Grinnell,[1] "The abundance or scarcity of the prairie hare in any district depends almost altogether on the number of wolves to be found in the same tract of country. Where all the coyotes and gray wolves have been killed or driven off, the hares exist in great numbers; but where the former are abundant, the latter are seldom seen. We saw none near the Missouri River, where the buffaloes, and consequently the wolves, were numerous; but at Camp

[1] Ludlow's Rept. Reconnaissance Yellowstone Nat. Park, 1876, p. 69.

Baker, where there were scarcely any wolves, the hares were very common."

The coyote is a most effective rabbit destroyer and accomplishes more good in this way than he usually receives credit for. His true value, however, is beginning to be appreciated by fruit growers. The following notes contributed by Mr. Vernon Bailey show how coyotes sometimes prey on jack rabbits. Mr. Bailey says:

In trapping on the greasewood flats about Kelton, in northern Utah, during the latter part of October, 1888, I noticed in many places that jack rabbits (*Lepus texianus*) had been killed and eaten by some animal. The feet, bits of skin, and fur were usually all that remained, but I immediately attributed this destruction to coyotes, and later on was able to verify the conclusion by finding remains of rabbits surrounded by fresh coyote tracks. In a walk of a mile it was common to see where a dozen had been eaten, and I could even see where the coyotes had run and caught the rabbits. I was surprised at the number killed, although both rabbits and coyotes were numerous. As I walked through the brush jack rabbits would jump up and run every few minutes, and coyotes were frequently seen. In this particular spot the numerous bunches of greasewood (*Sarcobatus*) scattered over the smooth valley bottom gave the coyotes a great advantage, enabling them to approach close to the rabbits and probably catch them before they got fairly started. It is very doubtful if a coyote can catch a jack rabbit in a fair race on open ground.

About five years ago the State of California offered a bounty of $5 each for coyote scalps. The act was passed March 31, 1891, and provided that such scalps should be deposited with the clerk of the board of supervisors of the county in which the animal was taken, within three months after the date of capture, and must be accompanied by an affidavit showing the time and place that the animal was killed. The law practically remained in force up to September 30, 1892, when the State board of examiners refused to pass on any claims for scalps taken subsequent to that date. The State controller reports that the sum paid for scalps during the eighteen months that the law remained in effect was $187,485, and that up to June 30, 1894, no less than 71,723 coyote scalps had been presented, with claims for bounty amounting to $358,615. This immense destruction of coyotes has permitted the increase of the smaller animals on which they feed. Complaints have been made that the rabbits are increasing in numbers and that the damage done by them is greater than that caused by the coyotes. As already stated, the county of San Bernardino in 1893 offered the unusually high bounty of 20 cents apiece on the rabbits, which, as a result of this wholesale destruction of coyotes, had so greatly increased in numbers. In this remarkable case of legislation a large bounty was offered by a county in the interest of fruit growers to counteract the effects of a State bounty expended mainly for the benefit of sheep owners!

EPIDEMICS.

Jack rabbits are subject to epidemics, which occasionally reduce their numbers very materially. These outbreaks are more or less local, but are reported every few years. According to Mr. George Watkins,

rabbits were found in large numbers in Ash Meadows, Nevada, previous to 1891, but in the spring of that year they were very rare. He attributed the decrease to the prevalence of an epidemic, which had been so severe as to render these animals almost extinct. In northeastern California Mr. A. C. Lowell, of Fort Bidwell, Modoc County, mentions seeing many dead rabbits in the autumn of 1893.

A similar occurrence is reported by Mr. F. Stephens, near Beckworth Pass, Plumas County. Speaking of a trip through northeastern California in August, 1894, he says: "The epidemic among hares was widespread through all the region I passed over north of Beckworth Pass, being perhaps most noticeable in the Madeline Plain on the South Fork of Pitt River and near the Nevada line south of Surprise Valley. In all these places I saw daily dozens of carcasses near the road. The only cause of death that I could see was the abundant warbles (*Cuterebra*) present in nearly all. It would seem, though, that these could only operate by lowering the state of health generally and that some contagious disease was present."

Dr. J. A. Allen[1] speaks of an outbreak that occurred in the vicinity of Great Salt Lake in 1870–71, destroying large numbers of *Lepus texianus* and *L. campestris;* and Prof. Marcus E. Jones states that another occurred in Utah in 1885 or 1886. A similar instance of the destruction of the Prairie Hare (*Lepus campestris*) has been mentioned by Mr. Gibbs and Dr. Cooper, which occurred in Washington north of the Columbia River about 1853.[1] Mr. Clark P. Streator, while at Pasco, Wash., near the mouth of Snake River, learned that another epidemic had occurred among the rabbits in the vicinity during the summer of 1890. Maj. Chas. Bendire states that the inhabitants of the Payette Valley, Idaho, claim that epidemics occur among the jack rabbits in that region every five or six years. The following table gives briefly the epidemics which have been reported in the West during the last forty years, but the list is very incomplete:

Partial List of Rabbit Epidemics in the West.

State.	Locality.	Date.	Authority.
California	Fresno County	Autumn, 1892	Geo. B. Otis, Selma.
Do	Modoc County	Autumn, 1893	A. C. Lowell, Fort Bidwell.
Do	Modoc to Plumas County	August, 1894	F. Stephens.
Idaho	Payette Valley	(Frequent) 1878	Maj. Chas. Bendire.
Nevada	Ash Meadows, Nye County	Spring, 1891	George Watkins, Ash Meadows.
Utah	Near Great Salt Lake	1870–71	J. A. Allen, Mon. N. Am. Rodentia, 1877, p. 372.
Do	Iron County	1877	M. Richards, jr., Parowan.
Do	Central Utah	1885 or 1886	Marcus E. Jones, Salt Lake City.
Washington	North of the Columbia	About 1853	Cooper & Gibbs, Pac. R. R. Repts., XII, Pt. II, 1860, pp. 87, 131.
Do	Near mouth Snake River	Summer, 1890	Clark P. Streator.

[1] Monographs of American Rodentia, 1877, p. 372.

A JACK RABBIT DRIVE NEAR FRESNO, CALIFORNIA, MAY 5, 1894.—RABBITS ENTERING THE CORRAL.

ATIO

CHAPTER V.

RABBIT DRIVES AND HUNTS.

CALIFORNIA.

In certain parts of California where jack rabbits are found in great numbers the 'drive' has proved the most successful means of extermination. Rabbit driving seems to have been first introduced in the San Joaquin Valley, near Tipton, Tulare County, in 1882, but did not attract much attention until the winter of 1887–88. This was during the 'boom' in southern California, and it is probable that the influx of people from the East, many of whom settled in the San Joaquin Valley, was one of the causes of the sudden interest in rabbit drives. Large tracts of land were brought under cultivation in sections where jack rabbits were very abundant, and it became absolutely necessary to adopt some effective means of protecting the newly planted orchards and vineyards.

The origin of the method, however, is somewhat obscure. It is said that the Mission Indians formerly hunted both cottontails and jack rabbits on horseback. A dozen or more Indians armed with clubs would engage in such a hunt, and, riding at full speed through the underbrush, would start the rabbits from their hiding places. The cottontails, confused by the clattering of the horses' hoofs and the shouts of the riders, would turn this way and that, and either dodge into their holes or squat close to the ground, only to be dispatched by a swift blow from a club. The jack rabbits, on the contrary, usually made for the open plain, where they were turned in their flight, and soon surrounded and killed.

Long before the settlement of the country by the whites, the Indians were accustomed to capture large numbers of jack rabbits with nets, the animals being surrounded and driven into an inclosure, where they were killed with clubs. One of the earliest accounts of this custom is contained in Townsend's 'Narrative of a Journey across the Rocky Mountains,' published in 1839 (p. 327). In speaking of the Blacktailed Jack Rabbit found near Walla Walla, Wash., he says: "The Indians kill them with arrows, by approaching them stealthily as they lie concealed under the bushes, and in winter take them with nets. To do this, some one or two hundred Indians, men, women, and children, collect and inclose a large space with a slight net, about 5 feet wide, made of

hemp; the net is kept in a vertical position by pointed sticks attached to it and driven into the ground. These sticks are placed about 5 or 6 feet apart, and at each one an Indian is stationed with a short club in his hand. After these arrangements are completed, a large number of Indians enter the circle, and beat the bushes in every direction. The frightened hares dart off toward the nets, and, in attempting to pass, are knocked on the head and secured. Mr. Pambrun, the superintendent of Fort Walla Walla, from whom I obtained this account, says that he has often participated in this sport with the Indians, and has known several hundred to be thus taken in a day. When captured alive, it does not scream, like the common gray rabbit (*Lepus sylvaticus*)."

The Indians of southern Oregon also carried on rabbit drives some years ago, especially near the Oregon-Nevada boundary line, near Fort McDermitt. Several hundred rabbits were killed at a time and utilized for food, while their skins were made into clothing. During his second expedition, Col. J. C. Frémont found the same method of capturing rabbits used by the Piutes of Nevada and eastern California.[1] In describing one of his camps on the east slope of the Sierra Nevada, evidently near the head of the Truckee River, he says, under date of January 31, 1844: "We had scarcely lighted our fires when the camp was crowded with nearly naked Indians; some of them were furnished with long nets in addition to bows, and appeared to have been out on the sage hills to hunt rabbits. These nets were perhaps 30 to 40 feet long, kept upright in the ground by slight stakes at intervals, and were made from a kind of wild hemp, very much resembling in manufacture those common among the Indians of the Sacramento Valley."

Maj. Chas. Bendire, while returning from Deep Spring Valley to Camp Independence, Cal., in November, 1866 or 1867, saw the Indians engaged in driving jack rabbits on the east side of Owens Valley, a few miles south of Bishop. A corral had been made by stretching low nets between stakes placed about 20 feet apart. Into the inclosure thus formed the animals were driven from a considerable area in the valley, and it was estimated that 300 or 400 rabbits were killed in this drive. The nets were made by the Indians, and each hunter was required to furnish his quota. Mr. F. V. Coville, botanist of the Death Valley Expedition, learned that similar nets were formerly used by the Indians of Ash Meadows, Nevada. These nets were made from the Indian hemp (*Apocynum cannabinum*), which furnishes a strong and excellent fiber. The same material was evidently used by the tribes in the eastern part of the State, for Bancroft, in speaking of the Indians near the Utah boundary, says: "The Gosh Utes take rabbits in nets made of flax twine, about 3 feet wide and of considerable length. A fence of sage brush is erected across the rabbit paths, and on this the net is hung. The rabbits in running quickly along the trail become entangled in the

[1] Rept. Expl. Expd. to Oregon and Calif., 1845, p. 227 (House Doc. No. 166.)

meshes and are taken before they can escape." (Native Races of the Pacific States, I, 1874, p. 428.)

The Moki Indians, of northeastern Arizona, have practiced rabbit driving for a number of years. The hunts are made both on foot and with horses, and the rabbits are simply surrounded instead of being driven into an inclosure. A peculiar kind of weapon, resembling a boomerang, is employed in these hunts, and is thrown with such accuracy that it proves very effective in the hands of Indians accustomed to its use. Similar drives were also made by the Indians in northern New Mexico, near Espanola. The Piutes and other tribes in Utah used to assemble in large numbers in a valley near Cedar City, where they engaged in a grand hunt each November, killing thousands of rabbits for their skins and for food.

The modern 'rabbit drives' are conducted on much the same plan as those of the Indians, but precautions are taken beforehand so that no escape is left for the animals when once surrounded. A square or triangular inclosure, open at one end, is constructed of wire netting —or of laths securely fastened close together. Often a corner of some old corral is simply made rabbit-tight, and from the open end of the pen diverging fences or wings are carried out in the form of a wide-mouthed V, sometimes for a distance of 2 or 3 miles (see fig. 1). The fences are occasionally made in sections, so that they can be transported from one place to another, and thus used for several drives. The Goshen Rabbit Drive Club, organized in the spring of 1888, had an 'outfit' which cost about $150, and was considered one of the best in the San Joaquin Valley; it was used mainly near Goshen, but was also moved to Huron, Fresno County, where it did duty for some time. This outfit consisted of 1 mile of wire netting 28 inches wide, and 400 iron stakes three-fourths of an inch in diameter and 3 or 4 feet long. The stakes were set 15 or 20 feet apart, and the netting fastened to them. At the apex of the wings a circular corral was built 60 to 200 feet in diameter and provided with a sliding gate (see p. 50).

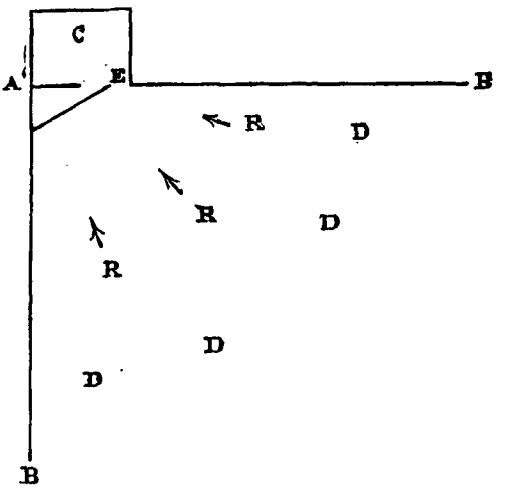

FIG. 1.—Diagram showing form of corral used in rabbit drive at Bakersfield, Cal., Jan 15, 1888.

A, B, portable wired picket fence, 1 mile long; C, corral; D, drivers; E, entrance to corral; R, rabbits. (From Am. Field, 1888.)

Mr. Charles S. Greene, in describing the drive at Traver on April 8, 1892,[1] states that the wings used on that occasion were made of wire

[1] Overland Monthly, 2d ser., XX, July, 1892, p. 54.

netting and were not more than 2 feet high. Although he saw rabbits leap much higher during the early part of the drive they made no attempt to escape over the fences when the wings were reached, the animals evidently being too wearied, as they had been driven for some distance. On the other hand, in a small drive which took place near Claremont on September 9, 1893, no wings or corral were built, but an attempt was made to utilize a corner of a stone wall 3 or 4 feet in height instead. The rabbits were driven only a short distance and when the wall was reached it is said that most of them went over it like sheep, and comparatively few were killed. In the great drive at Wildflower, Fresno County, the wings, made of wire netting, were 3 feet in height and extended for a distance of 7 miles, converging toward a circular corral at the apex.[1]

A drive always means a gala day, and is a favorite way of celebrating some special occasion. The announcement is the signal for a gathering of the clans from all the neighboring country and the population of the place is increased to several times its normal size when such an event takes place. Excursionists are attracted in large numbers by the special rates offered by the railroads, and sometimes come from points as far distant as San Francisco and Sacramento. Upon the appointed day large numbers of people turn out armed with sticks and clubs, and, scattering over a considerable area, start the rabbits and drive them toward the mouth of the corral. Every available vehicle is pressed into service but the larger part of the throng is usually on foot. The lines gradually close in, and the frightened rabbits, urged on by blows and shouts, rush blindly into the opening between the wings and are gradually crowded toward the narrow end of the pen where they are soon dispatched with clubs. Firearms are seldom used either in driving or killing, as clubs are cheaper, safer, and equally effective. The drives take place in winter or spring, and the number of rabbits killed varies from a few hundred up to ten or even twenty thousand in a single day. The town of Traver regularly celebrates its birthday in April by a rabbit drive and barbecue. On April 8, 1892, it was estimated that no less than 6,000 persons were present, and more than 4,000 people and 1,000 teams took part.

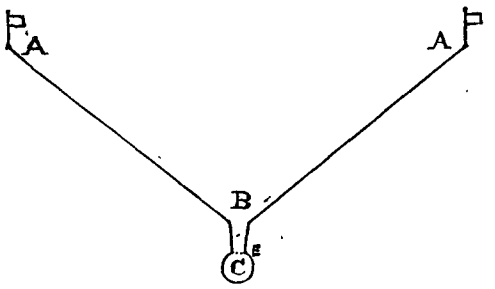

FIG. 2.—Diagram showing form of portable corral used by the Goshen Rabbit Drive Club.

A, B, wings of wire netting each half a mile long; C, corral 60 to 200 feet in diameter; E, sliding gate. (From M. S. Featherstone.)

[1] See figure in Scientific American, LXI, No. 19., Nov. 9, 1889, p. 295.

RESULT OF THE GRAND ARMY RABBIT DRIVE AT FRESNO, CALIFORNIA—20,000 JACK RABBITS KILLED.

(From photograph by Stiffler.)

A writer in the Chicago Tribune of October 1, 1893, thus graphically describes one of the largest drives which has taken place in the vicinity of Fresno, Cal.:

A close fence forming the corral is built about 500 yards square, with an opening or entrance for receiving the drive at one end, the opening being perhaps 50 feet wide. This is the finishing point of the drive, and will hold thousands of rabbits. From this opening diverge two fences, close enough to keep the rabbits from jumping through, about 5 feet high. These two fences diverge from the entrance for about 3 miles, increasing in their distance apart as they increase in distance from the entrance. * * *

By 7 o'clock in the morning all is bustle and preparation for the drive. Some men have heavy sticks and some heavy clubs, but no pistols or any kind of firearms are allowed, and no dogs. The sticks and clubs are used to beat the brush and to kill the rabbits at the finish.

A general is appointed to give orders, and under him are those who keep the lines in order. But sometimes they are anything but orderly. The order to start being given along the line, the cavalcade rushes forward. Boys with hoots and cries run hither and thither, wielding their sticks. Men on foot in advance lines are followed by those on horseback and in vehicles. Those on foot seem to have the best success in putting up the rabbits. * * *

After advancing a few miles the commencement of the fences diverging from the corral can be seen. The scene is humorous at times, when a horseman is seen dashing at full speed after a jack rabbit and a man on foot running in another direction after another. Now hundreds of the poor creatures are easily discerned as the fences appear on the left and right, miles apart. Many try the back track only to meet death in the attempt. All the horsemen gallop in cowboy style, some with long sticks in their hands. Great numbers of rabbits dash in every direction in front of the advancing hosts, and far ahead the long ears of hundreds more can be seen racing for life, occasionally crouching and then starting ahead again, but still surely advancing into the inevitable death-trap. The close proximity to the finish makes the chase exciting. Those on foot are heated and eager. The fence on each side is closing in fast, and although still some distance from the corral the screaming of the poor creatures can be heard as they find their retreat cut off.

The climax of the drive is now at hand. Hundreds of men and boys rush in every direction. The horsemen and carriages partly hide the view. The clouds of dust are stifling. Now the screeching of the rabbits can be heard above everything, and the ground is covered with dead rabbits by the dozen. At the corral entrance the scene is indescribably pitiful and distressing. * * * To slash and beat the poor screaming animals to death is the work of but a short time, but it brings tears to many an eye, and makes the heart sore to witness the finish. It is a relief to everybody when all is still, when the trying day is at an end. The result of the drive at Fresno was 20,000 dead rabbits.

The rabbits killed in the drives are utilized in various ways. If they are in good condition some are dressed and shipped to market where they find a ready sale. But usually the drives are carried on solely for the purpose of exterminating the pests. In localities where a bounty has been offered the ears are collected for 'scalps' and the bodies not saved for food are either used for fertilizing purposes, fed to hogs, or thrown away.

Drives have occurred in nine counties of California, viz: Inyo, Los Angeles, Modoc, Fresno, Kern, Kings, Madera, Merced, and Tulare. With the exception of those in Inyo, Los Angeles, and Modoc, all have

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taken place in the southern part of the San Joaquin Valley. Data are available for only a few drives east of the Sierra Nevada, one being the Indian hunt already mentioned, which took place in 1866, near Bishop, Inyo County, and the others in Modoc County in the extreme northeastern corner of the State—in Surprise Valley, just east of the Warner Mountains, and near Likely, on the South Fork of Pitt River. It may also be noticed that the drive at Claremont, Los Angeles County, is the only one which has occurred at a point well within the range of *Lepus californicus*, and although it resulted in the destruction of only about a hundred rabbits is especially interesting, as it seems to be one of the few drives in which the California Jack Rabbit alone was killed. All the large drives have been made in localities where the Texan Jack Rabbit is the predominant if not the only species. The largest drives have occurred in the vicinity of Bakersfield and Fresno. They usually extend over considerable country, and one of the Fresno drives has been described by Mr. Charles H. Townsend, in which nearly 2,000 horsemen took part. This hunt covered some 20 square miles, and about 15,000 rabbits were driven into a central corral and killed. (Forest and Stream, XXXVIII, March 3, 1892, p. 197.)

ORIGIN OF THE DRIVES.

The feasibility of driving jack rabbits into a corral for wholesale destruction was demonstrated about twenty years ago; but rabbit driving as now carried on, began within the last decade. At first the animals were shot instead of being killed with clubs, and these hunts were known as shotgun drives.

Mr. George W. Stewart, editor of the Visalia Delta, has kindly contributed the following notes concerning the early drives in California:

The first rabbit drive in the San Joaquin Valley, and probably in the State, occurred in the year 1875. The firm of Haggin & Carr had begun to farm a large body of land in Kern County, at the southern end of the San Joaquin Valley, which up to that time had been used only as a cattle range. The manager, a Mr. Souther, was much annoyed by the ravages of thousands of jack rabbits on what is known as Kern Island [a tract of land about 15 miles long] formed at that time by branches of Kern River. Mr. Souther collected a large number of his vaqueros and other ranch hands, and these men, mounted and on foot, surrounded a large territory and gradually closed their lines toward a large cattle corral, into which the rabbits were driven. Many rabbits escaped through the line, but the result of this first drive was 1,200 rabbits and 2 coyotes.

The next great slaughter of jack rabbits occurred eleven years later near Hanford, now the county seat of Kings County. Notice had been given beforehand, and on March 3, 1886, about 250 men from Hanford and the adjacent country, armed with shotguns (rifles and pistols were barred), surrounded a large area of country 6 miles south of the town. As the circumference of the circle gradually lessened, the shooting commenced, and when less than a mile in diameter the firing was incessant, the continuous discharge making the noise of a small battle. When the last jack rabbit had been shot the army halted for a lunch. A number of men had shot as many as 50 rabbits each, and it was estimated that 3,000 had been slain. In the afternoon a fresh supply of ammunition was secured and another smaller tract of

country was surrounded and the battle continued. The result of the afternoon's work was 1,000 hares, making 4,000 for the day. One result of this exciting day was a realization of the danger of using guns in this manner; several people were peppered with shot, but none were seriously injured. * * *

The following year, 1887, the rabbits had become so destructive on the great Miller & Lux ranch, on the west side of Merced County, that men were employed to kill them. The hunters were supplied with horses, wagons, and ammunition, and were paid 5 cents for every rabbit killed. Over 7,000 were killed on that one ranch during the season.

The first large rabbit drive on the plan afterwards adopted took place near Pixley, in Tulare County, on November 14, 1887, a year and a half after the Hanford slaughter. Firearms of all kinds were forbidden, and dogs were not allowed within the lines. A corral of rabbit-proof wire was made, and from its entrance two V-shaped wings extended a distance of a mile and a half. Into this space the rabbits were driven. Many hundreds stampeded and broke through the line, but the result of the drive was 2,000.

The modern method of driving rabbits into a corral seems to have originated with Mr. W. J. Browning, a professional hunter, of Tipton, Tulare County. Stimulated by an offer of $1,000 for 1,000 live jack rabbits for coursing, Mr. Browning undertook to capture the animals by driving them into a corral made by stretching fish nets between posts. In a letter dated January 15, 1895, he says: "I commenced the business of trapping jack rabbits with a corral drive net, with wings about half a mile long, during the summer of 1882. I have shipped many thousands to all parts of the country, alive, for coursing purposes. * * * In driving, I use six or eight men mounted on good horses, and in this manner usually trap from 50 to 500 jacks. The big drives of this State were patterned after my system, as the first drive I ever heard of outside of my own was made [at Pixley] in this county in 1887, in the month of November."

In order to obtain all the information possible on the subject of rabbit driving, Mr. J. Ellis McLellan, a field agent of the division, was detailed to visit Merced, Fresno, Bakersfield, and other points in the San Joaquin Valley in the autumn of 1894. Mr. McLellan gathered many facts of interest, and the following brief account has been mainly condensed from his reports, while the list of drives on pages 55–57 is largely the result of his energy in collecting data.

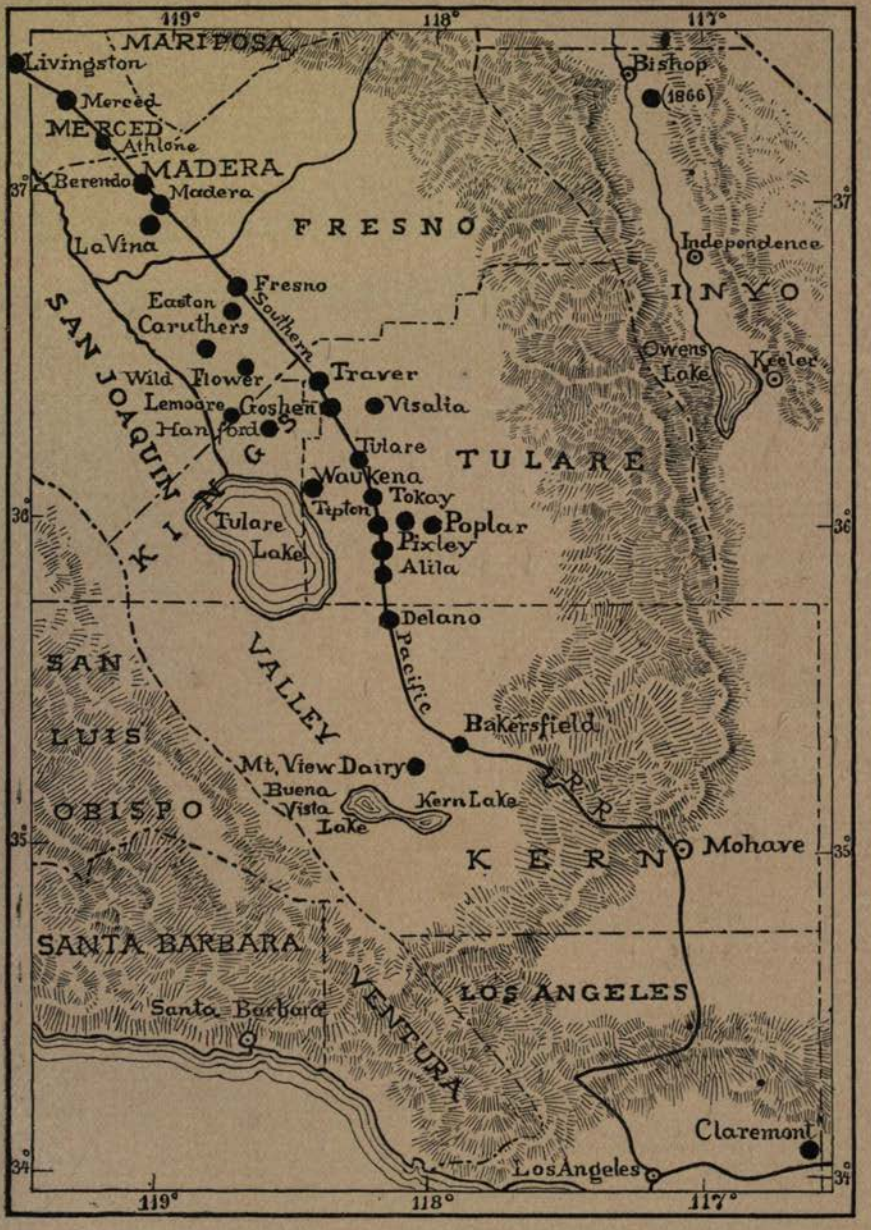
Early in the autumn of 1887 the question of taking measures for a wholesale destruction of jack rabbits was discussed in Kern County, but nothing was done for some months, and the project would probably have proved a failure through apathy or opposition had it not been vigorously agitated by the press. In the meantime, however, an experiment was made at Pixley, Tulare County, and the first public drive took place there on November 14, 1887. Two thousand rabbits were killed, and it was demonstrated that jack rabbits could be successfully driven into a corral. Another drive took place on December 3, and 1,000 more were slaughtered. Rabbit driving began in earnest in Kern County on January 2, 1888. The first drive was made near

Bakersfield, and was followed by others at intervals of a week or ten days with such success that the method attracted widespread attention throughout the valley. Great interest was aroused in Tulare County, and on February 25 the 'Pioneer Rabbit Drivers' Club' was formed and driving was undertaken by various towns in quick succession. The first drive near Tipton took place January 28, at Tulare on February 1, at Waukena February 11, at Visalia March 16, and at Traver April 7. Not to be outdone by Kern and Tulare counties, the citizens of Fresno met on February 8, and decided to arrange for a rabbit drive and barbecue, which was held on March 16. An association for rabbit driving was also organized in Merced County, and the first drive took place at Merced on March 24. During this time the matter seems to have been dropped at Pixley and the credit of originating the novel method of rabbit destruction was claimed by several other towns.

In February and March, 1888, rabbit driving seems to have reached its height in the San Joaquin Valley. It was estimated by the newspapers that nearly 20,000 rabbits were killed in Tulare County during March alone; while about 40,000 were destroyed in Fresno, and 70,000 each in Kern and Tulare counties during the spring of 1888. With the close of this season there was a noticeable falling off in the number of drives, either through lack of interest or because the rabbits had decreased in numbers to some extent. Comparatively few took place in 1890 and 1891, but in the spring of 1892 several large ones were made in Fresno County. The largest on record occurred between Easton and Oleander, 10 or 15 miles southwest of Fresno, and formed the closing event of an encampment of the Grand Army of the Republic at Fresno, March 12, 1892. It is said that 8,000 people were present, and the estimates of the number of rabbits killed vary from 20,000 to 30,000 (see Pl. IV). The central location of Fresno makes it an easy matter to bring together large numbers of people at short notice. Since 1892 there has been a still further decrease both in the number and size of the drives, and except at Traver, hardly any large ones have taken place in the State. The custom has been somewhat revived during 1893 and 1894 in Modoc County, where it is said a few drives were held in 1889.

It is impracticable to give a complete list of all the drives or an accurate statement of the number of rabbits killed. The figures published in newspapers are probably often exaggerated, but in most cases afford the only data available. With the assistance of many correspondents statistics for about a hundred and fifty of the more important drives have been collected.[1] As shown by the following table, more than 370,000 rabbits have been destroyed, but these probably represent only a small proportion of the total number actually killed in California.

[1]The writer is indebted to many persons for aid in the preparation of the following list. Besides those named below should be mentioned Messrs. Charles H. Shinn, of Berkeley, Walter E. Bryant, of Oakland, and F. H. Holmes, of Berryessa, who have assisted in various ways.



MAP SHOWING LOCATION OF RABBIT DRIVES IN SOUTHERN CALIFORNIA.

Drives have occurred at each place marked with a black spot.

List of California Rabbit Drives.

Locality.	Date.	Rabbits killed.	Authority.
Fresno County.			
Caruthers (6 miles west)	Feb. 22, 1892	7,460	Alvah A. Eaton.
Easton (12 miles southwest of Fresno).	Feb. 13, 1892	[1] 14,000	Weekly Fresno Expositor, Feb. 17, 1892; Forest and Stream, XXXVIII, Mar. 3, 1892, 197—15,000.
Do	Mar. 12, 1892	[2] 20,000	Photograph by F. M. Stiffler, Oakland
Do	Mar. 18, 1892	[3] 2,000	Weekly Fresno Expositor, Mar. 22, 1892.
Fresno (5 miles south)	Mar. 16, 1888	1,500 / 900	Fresno Daily Republican, Mar. 17, 1888; Expositor, Mar. 22.
Do	Mar. 24, 1888	[4] 14,723	Fresno Daily Republican, Mar 25, 1888.
Do	Apr. 12, 1888	300	Fresno Daily Republican, Apr. 13, 1888.
Do	Apr. 25, 1888	1,200	Fresno Expositor, Apr. 25, 1888.
Fresno (10 miles south)	Mar. 23, 1889	151	Fresno Daily Republican Mar 24, 1889.
Fresno	Mar. 13, 1893	.....	Photograph by E. R. Higgins Fresno.
Do	Mar. 18, 1893	10,500	Chicago Daily News, May 10, 1893.
Do	May 5, 1894	1,000	Daily Evening Expositor, May 5, 1894.
Huron	July 12, 1891	2,500	Tulare County Times (Visalia), July 16, 1891.
Wild Flower	Mar. 14, 1888	.....	Weekly Visalia Delta, Mar. 29, 1888.
Do	Mar. 1, 1889	[5] 12,000	Scientific Am., LXI, Nov. 9, 1889, p. 295.
Kern County.			
Bakersfield	Jan. 2, 1888	[6] 1,126 / 796	San Francisco Mining and Sci. Press, Jan. 28, 1888, p. 51.
Do	Jan. 10, 1888	[7] 5,075 / 500	Do.
Do	Feb. 9, 1888	3,500	Weekly Kern County Echo, Feb. 16, 1888.
Bakersfield (Houghton dairy)	Oct. 1, 1888	[8] 1,600	Weekly Kern County Echo, Oct. 8, 1888.
Bakersfield (4 miles west)	Jan. 20, 1889	200	Weekly Kern County Echo, Jan. 24, 1889.
Bakersfield (Rosedale, 3 miles north).	May 3, 1891	1,500	Weekly Kern County Echo, May 7, 1891.
Do	May 16, 1891	2,500	Weekly Kern County Echo, May 21, 1891.
Do	June 6, 1891	3,500	Gus. Kratzmer, Bakersfield.
Bakersfield (5 miles south)	June 10, 1894	1,000	Weekly Kern County Echo, June 14, 1894.
Bakersfield (6 miles southeast).	Dec. 9, 1894	350	C. A. Nelson, Bakersfield.
Do	Dec. 16, 1894	500	B. L. Brundage, Bakersfield.
Do	Dec. 23, 1894	200	Do.
Delano	Feb. 4, 1888	5,500	Delano Courier, Feb. 10, 1888.
Delano (10 miles southwest)	Feb. 19, 1888	5,500	Delano Courier, Feb. 24, 1888.
Delano (9 miles west)	July 13, 1888	10,000	Delano Courier, July 20, 1888.
Delano	Nov. 14–Dec. 31, 1894.	[9] 25,000	Hill & Conrad, Delano.
Haggin & Carr Ranch, Kern Island.	1875	1,200	Geo. W. Stewart, editor Visalia Delta.
Mount View dairy [10] (13 miles southwest of Bakersfield).	Jan. 15, 1888	[11] 3,500	Weekly Kern County Echo, Jan. 19, 1888.
Do	Jan. 23, 1888	2,000	Weekly Kern County Echo, Jan. 26, 1888.
Do	Jan. 30, 1888	5,000	Weekly Kern County Echo, Feb. 2, 1888.
Do	Feb. 5, 1888	5,000	Weekly Kern County Echo, Feb. 9, 1888.
Mount View dairy [10] (13 miles southwest of Bakersfield) (shotgun drive).	Feb. 12, 1888	500	Weekly Kern County Echo, Feb. 16, 1888.
Mount View dairy [10] (13 miles southwest of Bakersfield).	Feb. 19, 1888	[12] 7,000	Weekly Kern County Echo, Feb. 23, 1888.
Mount View dairy [10] (13 miles southwest of Bakersfield) (shotgun drive).	Feb. 25, 1888	1,000	Weekly Kern County Echo, Mar. 2, 1888.
Do	Mar. 4, 1888	1,946	Weekly Kern County Echo, Mar. 8, 1888.
Do	Mar. 3, 1889	4,428	Shooting and Fishing, V, Mar. 28, 1889, 13.

[1] Actual count—7,000 in the corral, 7,000 dead outside.
[2] The great G. A. R. drive, which took place between Easton and Oleander; the largest drive on record. The Weekly Fresno Expositor of March 16, 1892, places the number of rabbits killed at 25,000.
[3] Badly managed; about 20,000 rabbits rounded up; all but 2,000 escaped.
[4] Two drives same day; 9,723 by actual count; about 4,000 hauled away before count began; 1,000 taken alive for Merced coursing match.
[5] Mr. M. S. Featherstone, of Goshen, states that only 8,000 were killed by actual count.
[6] 2,500 estimated to have been killed altogether.
[7] 500 estimated to have been killed outside the corral.
[8] Private drive, covering 16 sections.
[9] Thirteen private drives. About two-thirds of these rabbits were shipped to the San Francisco market.
[10] Returns for these drives vary. Messrs. Nelson & Bailey have circulated a clipping from the Kern County Echo with their photograph of the drive of March 4, 1888, which gives the following figures: January 2, 2,500; January 8, 6,000; January 15, 5,500; January 23, 2,000; January 30, 4,000; February 5, 5,000; February 9, 500; February 12, 4,500; February 19, 7,000; February 23, 1,500; March 4, 2,000.
[11] 3,000, according to N. E. White in American Field, XXX, November 3, 1888, 410–411.
[12] Actual count, first drive, 5,500; second, 1,500.

List of California Rabbit Drives—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Kings County.			
Hanford (shotgun drive)	Mar. 3, 1886	3,000 1,000	George W. Stewart, editor Visalia Delta.
Hanford (Cross Creek)	Mar. —, 1888	1,250	Weekly Visalia Delta, Mar. 29, 1888.
Hanford (Half way to Traver)	Apr. 22, 1888	[1]4,569	Weekly Visalia Delta, Apr. 26, 1888.
Los Angeles County.			
Claremont	Sept. 9, 1893	100	Pomona Times, Sept. 13, 1893.
Madera County.			
Berendo (Desmond Ranch)	Mar. or Apr., 1888.	5,000	H. D. Crow, Berendo.
Do	....do	250	Do.
Berendo (Miller Ranch)	....do	500	Do.
Berendo	Jan. or Apr., 1889.	400	John J. Purkner, Madera.
Berendo (Miller Ranch)	Feb. or Mar., 1892.	400	H. D. Crow, Berendo.
Berendo	1892	.....	H. D. Crow and Miss L. K. Gozzoli, Berendo.
Do	Feb. 24, 1895	2,900	J. F. Ward, Berendo.
Do	Feb. 28, 1895	3,000	Do.
Do	Mar. 9, 1895	1,500–1,600	Do.
John Brown Colony	Apr. or May, 1890.	.....	John J. Purkner, Madera.
Do	Spring, 1891	2,500	L. U. Hoskins, Madera.
Do	Spring, 1892	1,200	Do.
Do	Mar. —, 1893	1,400–1,500	Do.
La Vina	Apr. —, 1890	750	John J. Purkner, Madera.
Madera (4 miles west)	Dec. 30, 1888	400	Weekly Visalia Delta, Jan. 10, 1889.
Madera (5 miles south)	Feb. —, 1889	2,500	John J. Purkner, Madera.
Madera (3 miles west)	Mar. 14, 1889	1,050	J. F. Ward, Berendo.
Madera	Apr. —, 1889	1,000	John J. Purkner, Madera.
Madera (5 miles south)	May —, 1889	1,500	Do.
Madera (3 miles west)	Feb. 17, 1895	250	Do.
Merced County.			
Athlone (10 miles west)	Spring, 1888	1,200–1,500	W. H. Bowden, Athlone.
Do	....do	1,200–1,500	Do.
Athlone (16 miles south)	....do	1,200–1,500	Do.
Hartley Ranch (near Berendo, Madera County)	Mar. 16, 1895	200	J. F. Ward, Berendo.
Hartley Ranch ?	Feb. 8, 1895	2,100	Do.
Livingston	Apr. 4, 1893	8,000	F. Crowell, Livingston.
Do	Apr. or May, 1893.	2,500	Do.
Do	Apr. 25, 1893	1,000	Do.
Do	1893 ?	250	Diary of D. L. Heffner, Merced.
Do	Apr. 4, 1894	2,000	F. Crowell, Livingston.
Merced	Mar. 24, 1888	1,000	San Joaquin Valley Argus, Mar. 24, 1888.
Do	Mar. 28, 1888	2,000	San Joaquin Valley Argus, Mar. 31, 1888.
Do	Apr. 4, 1888	2,800	H. N. Wilson, Merced.
Do	Apr. 16, 1888	1,700	San Joaquin Valley Argus, Apr. 21, 1888.
Do	Mar. 12, 1889	2,000	San Joaquin Valley Argus, Mar. 16, 1889.
Modoc County.			
Cedarville (3–12 miles south)	June–July, 1893.	3,000	T. H. Johnston, Cedarville.
Cedarville (7 miles north)	Dec. 20, 1894	260	Do.
Lake City	Jan. 5, 1893	990	S. O. Cressler, Lake City.
Do	Jan. 15, 1893	500	Do.
Do	Jan. 20, 1893	250	Do.
Do	Jan. 25, 1893	345	Do.
Lake City (2 drives)	Feb. —, 1893	275	Do.
Lake City	Dec. 30, 1894	250	Do.
Do	Jan. 5, 1895	60	Do.
Do	Jan. 20, 1895	50	Do.
Likely (several drives)	1889	.....	Wm. J. Dorris, Likely.
Tulare County.[2]			
Alila	Sept. 15, 1888	3,000	Delano Courier, Sept. 21, 1888.
Do	Sept. 22, 1888	.....	Delano Courier, Sept. 22, 1888 (announced).
Goshen	1888	850	Shooting and Fishing, V, No. 13, Jan. 24, 1889, p. 10.
Do	Apr. 11, 1888	[3]994	Weekly Visalia Delta, Apr. 12, 1888.
Do	Jan. 20, 1889	1,200	Tulare Register, Feb. 1, 1889.
Do	Feb. 15, 1889	[4]2,500	M. S. Featherstone, Goshen.
Do	Mar. —, 1889	700	Weekly Visalia Delta, Mar. 21, 1889.

[1] 3,969 in the corral, and 600 estimated to have been killed outside, all on one section of land.
[2] Mr. D. K. Zumwalt, of Visalia, has kindly furnished the statistics for 16 drives in this county, and several in Fresno, Kern, and Kings counties.
[3] About 200 more were killed outside; a second drive was made later, but the figures were not given.
[4] 2,390 actually driven into the corral; the others killed outside.

List of California Rabbit Drives—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Tulare County—Continued.			
Jonesa	Apr. 9, 1888	4,000	Weekly Visalia Delta, Apr. 26, 1888.
Oakdale	Mar. 18, 1888	[1] 2,200	Weekly Visalia Delta, Mar. 29, 1888.
Oakdale (3 miles south)	Mar. 24, 1888[2]	1,211	Do.
Pixley	Nov. 14, 1887	[3] 2,000	Tulare Register, Nov. 18, 1887.
Do	Dec. 3, 1887	1,000	Tulare Register, Dec. 9, 1887.
Do	March, 1888	1,300	Samuel Shilling, Pixley.
Do	June 1, 1888	8,000–10,000	John W. Harper, Pixley.
Pixley (12 miles south)	May —, 1889	1,000	Samuel Shilling, Pixley.
Pixley	Aug. 20, 1893	300–400	John W. Harper, Pixley.
Do	Nov. (7?), 1894	3,900	Maj. C. J. Berry, Visalia.
Do	Dec. 14, 1894	200	John W. Harper, Pixley; G. J. Martin, Poplar—290.
Pixley (other drives[4])		3,000–4,000	John W. Harper, Pixley.
Plano (18 miles west)			William Thomson, Plano.
Poplar	Jan. 20, 1895	145	G. J. Martin, Poplar.
Do	Jan. 27, 1895	235	Do.
Tipton (Lake View school)	Jan. 28, 1888	420	W. J. Browning, Tipton.
Tipton	May 18, 1889	117	Tulare Register, May 24, 1889.
Tokay (5 miles south Tulare)	Mar. 10, 1888	2,500	Tulare Register, Mar. 16, 1888.
Tokay	Feb. 25, 1890		M. S. Featherstone, Goshen.
Traver (Settlers ditch, southwest of town)	Apr. 7, 1888[5]	1,000	Weekly Visalia Delta, Apr. 12, 1888.
Traver	Feb. 26, 1889	1,200	Fresno Daily Republican, Mar. 2, 1889.
Do	Mar. 8, 1889		Fresno Daily Republican, Mar. 10, 1889.
Do	Apr. —, 1891	1,500	Henry Lahann, Traver.
Do	....do....	500	Do.
Do	Mar. 6, 1892[6]	4,000	Los Angeles Times, Mar. 7, 1892.
Do	Apr. 8, 1892	4,000	C. S. Greene, Overland Monthly, 2d ser., XX, July, 1892, pp. 49–58.
Do	Feb. – Apr., 1892.	12,000	4 drives,[7] Henry Lahann, Traver.
Do	Apr. 8, 1893	2,500	Henry Lahann, Traver.
Do	Feb. 25, 1894	2,000	Do.
Do	Mar. 4, 1894	1,500	Do.
Do	Apr. 7, 1894	2,000	Visalia (Tulare County) Times, Apr. 12, 1894.
Traver (10 miles southwest)	Mar. 31, 1895	370	S. S. Cederberg, Hanford.
Traver	Apr. 8, 1895	300	Henry Lahann, Traver.
Tulare (Mitchell Ranch, 6 miles west).	Feb. 11, 1888	[8] 5,000	Weekly Visalia Delta, Feb. 16, 1888.
Tulare (Birch Ranch, 7 miles west).	Feb. 15, 1888?	2,500	Photograph from D. K. Zumwalt, Visalia.
Tulare (7 miles south)	Feb. 20, 1888	1,000	Tulare Register, Feb. 24, 1888.
Tulare	Feb. 24, 1888	2,300	Weekly Visalia Delta, Mar. 1, 1888.
Do	Mar. 2, 1888	3,000	Tulare Register, Mar. 2, 1888.
Tulare (6 miles east)	Mar. 4, 1888	2,232	Tulare Register, Mar. 9, 1888.
Tulare	Mar. 9, 1888	2,000	Tulare Register, Mar. 16, 1888.
Tulare (Parkwood, 7 miles northwest).	Mar. 24, 1888	2,200	Tulare Register, Mar. 30, 1888.
Tulare	Feb. 9, 1889	1,400	Tulare Register, Feb. 10, 1889.
Do	Feb. 25, 1889	350	Tulare Register, Feb. 28, 1889.
Do	Mar. 30, 1889	200	Tulare Register, Apr. 5, 1889.
Tulare (Mitchell Ranch, 6 miles west).	Feb. —, 1890		M. S. Featherstone, Goshen.
Visalia	Mar. 16, 1888	3,300	Weekly Visalia Delta, Mar. 29, 1888.
Visalia (north of town)	Mar. 18, 1888	1,400	Do.
Visalia (?) (McCann Ranch)	Apr. 14, 1888	400	Weekly Visalia Delta, Apr. 19, 1888.
Waukena	Feb. 11, 1888	5,000	Weekly Visalia Delta, Feb. 16, 1888.
Do	Feb. 2, 1889	1,067	Weekly Visalia Delta, Feb. 7, 1889.
Do	June 11, 1894	500	W. F. Glass, Waukena.
Do	June 30, 1894	500	Do.
Do	Nov. 16, 1894	150	Do.

[1] 300–400 more probably killed before reaching the corral.
[2] Another drive announced for March 29, 1888.
[3] First public drive in California.
[4] Several small shotgun drives took place about 1882 and 1883.—J. Ellis McLellan.
[5] Another drive announced for April 15, 1888.
[6] Third drive of the season. Another was planned for March 13, 1892, but no report has been received.
[7] Six drives in all took place during February, March, and April, in which 20,000 were killed.
[8] About 1,000 more estimated to have escaped. Another drive planned for March 18.

RESULTS OF THE DRIVES.

Although it is practically impossible to give all the rabbit drives which have occurred in California during the last eight years, still this list of 155 drives, including the more important ones during the twenty years from 1875 to 1895, should be sufficient to show the progress of

rabbit driving and the effect of this means of extermination. The general results may be tabulated as follows:

Summary of California Rabbit Drives.

	Before 1888.	1888.	1889.	*1890.	1891.	1892.	1893.	1894.	1895.	Misc.	Total.
Number of drives..	4	55	20	1	7	12	15	29	12	.....	155
Rabbits killed.....	8,200	158,492	34,963	750	14,500	65,060	32,010	41,310	11,160	3,750	370,195
Average number per drive.....	2,050	2,881	1,748	.....	2,071	5,421	2,134	1,424	930	.....	2,387

*Returns incomplete; 4 drives reported but figures given for only 1.

An examination of these figures shows that in the total of 155 drives 370,195 rabbits were killed, or an average of nearly 2,400 in each drive. Returns for years previous to 1888 have been received for only 4 drives in which 8,200 rabbits were killed, but during the spring of 1888 the number of drives suddenly increased to 55, and then, as the novelty wore off or the rabbits became scarcer, decreased to 7. During the same period the number of rabbits slaughtered decreased from nearly 160,000 in 1888 to 14,500 in 1891. In 1892 there were a few more drives and a decided increase in the slaughter of rabbits, due to the large drives in Fresno County. The total of 65,060 rabbits was second only to that of the season of 1888, but in the last three years there has been a decided falling off in the totals. The apparent increase in the number of drives in 1893 and 1894 is due in part to the small hunts in Modoc County, but the number in the San Joaquin Valley has continued to decline regularly until 1895, when only 12 small drives were reported.

The largest number of rabbits killed in any single drive is said to have been 20,000, but the average of all the drives for any one year has varied from 5,400 down to 930 the past season. By far the greater number have been killed in the southern part of the San Joaquin Valley in a strip about 170 miles in length and 30 miles in width. If the small drives in the northern part of the State and the single one in Los Angeles County are omitted, as well as the two early shotgun drives, the result is reduced to about 356,400 rabbits killed in 140 drives during eight years, or an average annual slaughter of about 44,500 rabbits in an area scarcely as large as the States of Connecticut and Rhode Island combined. The success of the drives is evident from the small number of rabbits killed during the last three years. This result, at least in Fresno County, is probably due in part to the appearance of an epidemic among the jack rabbits soon after the large drives of 1892. One correspondent writes from Selma: "Just as it had been found possible to control their presence in the more thickly settled part [of Fresno County] an epidemic appeared among them and they died by hundreds and by thousands. * * * Since then we have kept a few dogs and the wire-screen fences have been gradually taken down, and now very few rabbits are to be found among the vines."

Whether the present diminution in numbers is only temporary remains to be seen, but this section of California is now being settled so fast that it seems hardly possible for the rabbits to increase to their former abundance under all the forms of destruction which can be used against them. The case is instructive in showing the combined effect of natural and other means of extermination. If rabbits could be systematically destroyed just after their numbers had been reduced by an epidemic, they would receive a setback from which they would not soon recover.

The decline of rabbit driving is hardly to be deplored. In the San Joaquin Valley a drive was made the occasion of a general holiday; the schools were closed and women and children joined the throng to assist in clubbing the rabbits or to watch the slaughter. It may be questioned whether such frequent scenes of butchery can have anything but an injurious effect on a community, and it is fortunate that the necessity for them does not now exist.

OREGON.

In Oregon the California method of destroying rabbits by drives has been recently introduced. Throughout the region east of the Cascades the black-tailed Texan Jack Rabbit (*Lepus texianus*) is very abundant and has become so troublesome in Lake County that $2,160 was expended for its destruction during the years 1888, 1889, and 1890. More than a dozen drives were made in December 1894, and January 1895, in the vicinity of Lakeview. In one of these, which took place on January 6, 1,975 rabbits were killed, while the total number slaughtered during the two months amounted to 12,202. Several drives, resulting in the destruction of 3,000 to 4,000 rabbits, have occurred during the winter of 1895–96, but in the absence of any detailed report they have not been included in the following table.

Partial List of Rabbit Drives in Oregon.

Locality.	Date.	Rabbits killed.	Authority.
Lake County.			
Lakeview	Dec. 18, 1894	1,654	C. U. Snider, Lakeview, Oreg.
Do	Dec. 20, 1894	1,767	Do.
Do	Dec. 22, 1894	685	Do.
Do	Dec. 24, 1894	826	Do.
Do	Dec. 27, 1894	1,592	Do.
Do	Dec. 30, 1894	300	Do.
Do	Jan. 3, 1895	973	Do.
Do	Jan. 6, 1895	1,975	Do.
Do	Jan. 10, 1895	1,146	Do.
Do	Jan. 17, 1895	304	Do.
Do	Jan. 20, 1895	200	Do.
Do	Jan. 24, 1895	280	Do.
Do	Other drives	500	Do.
Total (12 drives)		12,202	
Average		1,016	

RABBIT HUNTS.

It may be of interest to consider the methods of destruction which have been used in other States. Two of the jack rabbits which occur in California (*Lepus texianus* and *L. campestris*) are common also in Utah, Idaho, and Colorado, and in some sections are excessively abundant. An entirely different method of extermination, however, is practiced from that adopted in California. Large numbers are killed with shotguns in regularly organized hunts, but rabbit drives, properly speaking, are now rarely made, except in Idaho.

UTAH.

According to Mr. M. Richards, jr., of Parowan, Utah, the club was formerly used in some of the rabbit hunts on the brush lands bordering Little Salt Lake, and as many as 2,000 rabbits have been killed in a drive, but this method has now been abandoned and shooting has been adopted instead.

Rabbit hunts have taken place since the earliest settlement of the State—nearly half a century ago—but when they were first held by the Indians is unknown. The Piutes, Goshutes, and Pahvan Indians were accustomed to resort to a large valley near Cedar City during the month of November, for the purpose of having a grand hunt, and thousands of rabbits were annually slaughtered.[1] Strangely enough, the first hunt among the whites of which we have any record probably occurred very near this place, and was participated in by a party of emigrants on their way from Salt Lake City to California in 1849. It was a portion of the same company which soon after experienced such hardships on the desert, and on account of whose sufferings the now celebrated Death Valley in California received its name. This early rabbit hunt probably took place in the month of October, 1849, somewhere in the region north of Little Salt Lake, either in Iron or Beaver County. Mr. W. L. Manly,[2] one of the members of the party, describes the hunt as follows:

"We came into a long, narrow valley well covered with sage brush, and before we had gone very far we discovered that this was a great place for long-eared rabbits—we would call them jack rabbits now. Everyone who had a gun put it into service on this occasion, and there was much popping and shooting on every side. Great clouds of smoke rolled up as the hunters advanced, and the rabbits ran in every direction to get away. Many ran right among the horses, and under the feet of the cattle and under the wagons, so that the teamsters even killed some with a whip. At the end of the valley we went into camp, and on counting up the game found we had over 500, or about one for every person in camp."

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[1] Coues & Yarrow, Rept. Geog. Surv. W. 100th Merid., V, Zool., 1875, p. 127.

[2] Death Valley in '49, 1894, pp. 110–111.

Mr. James L. Bunting, of Kanab, writes that between 1858 and 1870 rabbits were very abundant on the land between the Jordan River and Great Salt Lake. In November and December hunters would go out almost daily in parties of from four to six each, and on some occasions as many as 500 rabbits were killed in a single day.

The hunts usually take place in the winter or early spring when the snow is on the ground, and are thus described by W. G. Nowers in a letter dated February, 1887. He says:

"Our mode of destroying these pests is to select two captains, who choose their associates from the community, and form two attacking parties, who ride or go with firearms, dogs, clubs, and so on, and lay siege to every rabbit caught sight of. In some instances the slaughter has amounted to nearly 1,000 for each side. These raids are waged on every favorable opportunity—after a snowstorm, or monthly, if no snow falls, as has been the case this winter."

Rabbit hunts have occurred in a number of places in southwestern Utah, but are less common in the northern part of the State. One, however, took place near Corinne during the summer of 1894. According to Prof. Marcus E. Jones, as many as a dozen or fifteen hunts have occurred annually during recent years. One of the largest is described by Mr. Vernon Bailey as having taken place near Panguitch, Garfield County, in 1885. It lasted three days, and some 80 men and boys took part, killing more than 5,000 rabbits within a few miles of the town. As will be seen from the following table, the recent Utah hunts are small in comparison with those in Colorado or the California drives.

Partial List of Rabbit Hunts in Utah.

Locality.	Date.	Rabbits killed.	Authority.
Beaver County.			
Beaver	Dec., 1886	5,000	Orson Alred, Beaver.
Do	1894	1,600	Do.
Do	Feb., 1895	2,300	Do.
Minersville*	July, 1887	2,000-3,000	Dotson & Son, Minersville.
Do	Dec., 1887, or Jan., 1888.	1,500-2,000	Do.
Boxelder County.†			
Corinne	Summer 1894	300-400	Editor Bugler, Brigham City.
Kelton		1,000	Conant Bros., Kelton.
Garfield County.			
Panguitch	1885	5,522	David W. Montague, Panguitch.
Iron County.‡			
Near Little Salt Lake ?	Oct. (?), 1849	500	W. L. Manly, 'Death Valley in '49', 110.
Cedar City	Feb. 24, 1894	527	Will C. Higgins, Cedar City.
Kanarraville	Dec. 21, 1893	172	Do.
Do	Jan. 28–Feb. 2, 1895.	169	Iron County Record Feb. 8, 1895.
Paragonah	Feb. 11–14, 1895	600	Iron County Record Feb. 15, 1895.
Parowan	Spring 1875	2,000	M. Richards, jr., Parowan. (Drive).
Do	Spring 1885	1,800	Do.
Do	Jan. 18, 1894	796	Will C. Higgins, Cedar City.
Do	Jan. 31, 1894	337	Do.
Summit	Jan. 20–26, 1895	1,290	Iron County Record Feb. 1, 1895.

*Messrs. Dotson & Son report that 21,000–22,000 rabbits were killed in two months in 1887 and 1888.

†A number of hunts seem to have occurred near Brigham City and elsewhere, which are necessarily omitted here in the absence of sufficient data. The county paid bounties on 12,758 rabbits during the years 1893, 1894, and 1895—see p. 43.

‡Mr. M. Richards, jr., of Parowan gives 9,000 as the probable number of rabbits killed in this county during 1894.

Partial lists of Rabbit Hunts in Utah—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Millard County.			
Corn Creek	Mar. 27, 1894	50-60	Marcus E. Jones, Salt Lake City.
Kanosh	Jan. —, 1893	1,800	James A. George, Kanosh.
Do	Jan. (19?), 1894	1,000	Do.
Sanpete County.			
Mount Pleasant	Dec. 30, 1894 to Jan. 12, 1895.	1,000	Several hunts. Postmaster.
Wayne County.			
Loa	Dec. 14, 1894	350	John T. Lazenby, Loa.
Central Utah	Dec. 3, 1893	2,762	John L. May, Salt Lake City.
Do	Nov. 29, 1894	1,379	Do.
Do	Dec. 8, 1894	656	Do.
Total (26 hunts)		37,215	

IDAHO.

A few large hunts have recently occurred in southern Idaho, but greater success has attended the introduction of the rabbit drive. A novel method is sometimes employed in Fremont County, the rabbits being baited by spreading a line of hay on the snow or on the ground, and after they are 'lined up' several can be killed at a single shot.

Mr. T. T. Rutledge, assistant director of the experiment station at Nampa, Canyon County, reports that a small hunt took place about September 1894, near that place, but the number killed is unknown. In the winter of 1894–95 about 2,600 jack rabbits were killed near Idaho Falls, Bingham County, and shipped to Eustice, Nebr., along with grain and provisions for distribution among the drought sufferers in that State. Another smaller hunt also occurred at Idaho Falls later on.

While these pages are passing through the press, reports have been received indicating that rabbit driving is being successfully carried on in the southern part of the State. At Marion, Cassia County, about 5,000 rabbits were killed in a drive on December 9, 1895. It was estimated that 500 people were present and that an area of country less than 3 miles square was driven over; 4,000 more rabbits were killed at the same place during the following week.

Farther east two smaller drives were held at Market Lake, Fremont County. In this case no corrals were built, the rabbits being simply driven into the railroad stock yards and afterwards shipped to Salt Lake City for distribution among the poor. The following list has been brought down to date as far as possible and includes five drives which occurred early in January, 1896:

Partial List of Idaho Rabbit Drives and Hunts.

Locality.	Date.	Rabbits killed.	Authority.
Bingham County.			
Idaho Falls	Winter 1894–95.	2,600	A. V. Scott, Idaho Falls.
Do	do		Do.
Canyon County.			
Nampa	Sept. —, 1894		T. T. Rutledge, Nampa.

RESULT OF THE JACK RABBIT HUNT AT LAMAR, COLORADO, DECEMBER 22, 1894—5,142 RABBITS KILLED.
(From photograph by Hallack.)

Partial List of Idaho Rabbit Drives and Hunts—Continued.

Locality.	Date.	Rabbits killed.	Authority.
Cassia County.			
Marion*	Dec. 7, 1895	5,000	C. A. Tolman, Marion.
Do	Dec. 9, 1895	2,000	Do.
Do	Dec. 14, 1895	2,000	Do.
Do	Dec. 31, 1895	1,200	Do.
Do	Jan. 3, 1896	150	Do.
Do	Jan. 4, 1896	1,600	Do.
Fremont County.			
Grant†	Feb. 1, 1895	247	Eli McEntire, Grant.
Do	Feb. 7, 1895	450	Do.
Do	Feb. 14, 1895	509	Do.
Do	Feb. 20, 1895	739	Do.
Lewisville	Jan. 9, 1896	990	Ed Ellsworth, Lewisville.
Market Lake*	Dec. 30, 1895	1,044	Do.
Do	Jan. 4, 1896	1,000	Do.
Rigby	Winter 1894–95.	2,000	E. P. Coltman, Idaho Falls.
Do*	Jan. 11, 1896	300	Ed Ellsworth, Lewisville.

* Drives.

† Hunts have been reported from Lewisville for February 14 and 26 (?), 1895, which are probably the same as those given in this list. Grant, Lewisville, and Rigby are all within a few miles of one another; the same hunt may be reported from different places and thus lead to confusion, particularly if no dates are given.

COLORADO.

During the last three years a series of rabbit hunts have taken place in eastern Colorado, resulting in the destruction of nearly 29,000 rabbits. As is the case with the hunts in Utah, no inclosures are built and shotguns are the only weapons used. The hunters are usually distributed over the ranches in the neighborhood and hunt singly or in small parties. The success of these hunts has led to the celebration each winter of a 'Rabbit Day,' which is set apart for the destruction of the pests. In reply to an inquiry concerning the origin of the custom at Lamar, Mr. J. T. Lawless, editor of the Lamar Sparks, wrote on March 4, 1895:

> This portion of Colorado was first settled in 1886, and in 1889 farming by irrigation was begun on an extensive scale. The territory under ditch is about 18 miles wide. North and south of this strip of irrigated land there is little vegetation, and the land is valuable chiefly as a stock range. After the first year of farming by irrigation, rabbits increased rapidly, and the farmers were greatly annoyed. The rabbits came from the rainbelt region for miles around and made their headquarters in the alfalfa and grain fields and the growing orchards of Prowers County. * * * The great increase in the number of rabbits caused much concern, and finally a big hunt was arranged to reduce their numbers. This hunt was confined to people of Lamar and the county. About fifty-five men participated, and they killed over 1,200 rabbits in one day. The following winter another hunt was arranged on similar lines, and the same number of men brought in about 2,000 rabbits. This hunt was followed by the first annual hunt, in which gunners from all parts of the State participated. That was the inauguration of Rabbit Day. Over 4,000 rabbits were killed, and these were drawn and shipped to Denver and Pueblo for distribution among the poor, to whom the meat was very acceptable.

One of the largest and most successful hunts was that of December 22, 1894, in which 101 gunners took part and secured 5,142 rabbits as the result of a day and a half of steady work (see Plate VI). When dressed, these jack rabbits usually average about 6½ pounds each, and

it was estimated that the game obtained in this hunt weighed nearly 5 tons. The annual hunt on December 19–20, 1895, was less successful, owing to a severe storm and deep snow; only about 1,600 rabbits were killed.

A unique feature of the Colorado hunts is the disposition of the game, which is distributed among the poor of Denver and Pueblo. The rabbits are transported free of charge by the railroads and distributed mainly under the direction of Rev. Thos. A. Uzzell, of Denver. This charitable work was begun about four years ago, and 250 jack rabbits were received the first winter; last season 4,500 were distributed in Denver alone, and it is said that over 5,000 have been given away each season for the last three years. In fact the success of the hunts at Lamar in December, 1893, January and December, 1894, was largely due to the efforts of Rev. Thos. A. Uzzell, who arranged for the shipment and distribution of the rabbits.

*List of Colorado Rabbit Hunts.**

Locality.	Date.	Rabbits killed.	Authority.
Brush, Morgan County	Dec. 28, 1894	700	Lamar Sparks, Jan. 3, 1895.
Lamar, Prowers County	Jan. 6, 1893	1,194	A. Van Deusen, Lamar.
Do	Dec. 22, 1893	1,799	Do.
Do	Jan. —, 1894	3,029	Do.
Do	Jan. 12–13, 1894.	4,500	Do.
Do	Nov. 25–26, 1894.	1,500	Do.
Do	Dec. 22, 1894	5,142	Do.
Do	Dec. 19–20, 1895.	1,600	Lamar Sparks, Dec. 26, 1895.
Las Animas, Bent County	Feb. 22, 1893	815	M. R. McCauley, Las Animas.
Do	Feb. 22, 1894	1,865	Do.
Do	Feb. 6–7, 1895	6,522	Jacob Weil and M. R. McCauley.
Total (11 hunts)		28,666	

* For descriptions of the hunts of December, 1893, and January, 1894, see Shooting and Fishing, Vol. XV, January 4, 1894, p. 221, February 1, 1894, p. 303, and American Field, Vol. XLI, March 10, 1894, p. 222. For annual hunt of Dec. 19–20, 1895, see Shooting and Fishing, Vol. XIX, Jan. 2, 1896, p. 225.

SUMMARY.

A comparison of the foregoing tables will show that California has accomplished much more in the way of rabbit destruction than Colorado, Idaho, Oregon, or Utah, notwithstanding the fact that hunts have been held in Utah for nearly half a century. Rabbit driving is now on the decline in California, but the number of hunts is rapidly increasing in the other States. The results may be tabulated as follows:

General Summary of 220 Jack Rabbit Drives and Hunts in the West.

	California, 1875–1895.	Oregon, 1894–95.	Utah, 1849–1895.	Idaho, 1894–96.	Colorado, 1893–95.	Total.
Number drives	*155	*12	‡26	‡16	†11	220
Total number rabbits killed	370,195	12,202	37,215	21,829	28,666	470,107
Average number per drive	2,387	1,016	1,431	1,364	2,606	2,137
Largest drives	20,000	2,000	5,500	5,000	6,500	.....

* Drives. † Hunts. ‡ Both drives and hunts.

CHAPTER VI.

VALUE OF THE JACK RABBIT.

The question may well be asked whether the jack rabbit has any value or can be utilized in any way. In 1890 the Royal Commission of New South Wales suggested that "rabbits may be used for food, either fresh, frozen, canned, jerked, or as soup; for their skins and fur in the manufacture of gloves and felt; for extracting glue and oil; and for reduction to manure."[1] Nevertheless they discouraged the principle of commercial utilization on the ground that it would lead to the preservation of the rabbits instead of their destruction. But after many experiments with poisons, diseases, traps, and other methods of destruction, and an outlay of millions of dollars for fences, this very method has recently been advocated as the most promising, by the Hon. J. H. Carruthers, Minister for Lands in New South Wales. In his opening address to the rabbit conference, held at Sydney on April 2, 1895, he said:

> One feature of the rabbit question has not, it is thought, received sufficient attention at the hands of the sufferers in this colony, and that is the commercial utilization of the animal. In the past suggestions of this character have met with condemnation on the ground that it would lead to the conservation of the rabbit, but it would appear that the time for such argument has disappeared. Experience in the past leads to the belief that the rabbit is a fixture, and there should be no reason why persons resident in localities suitable for the purpose should not seriously consider why the animal should not be made to contribute to the cost of its own destruction. It is, of course, apparent that operations of this character would only be possible over a limited area of the infested country; but with the easy means of reaching foreign markets, it is worthy of consideration whether the carcass of the rabbit may not be used as an article of food, either frozen or canned, and whether the skins and fur may not be profitably applied in the manufacture of gloves and felt.[2]

In this country, however, the larger hares have been used in only a few of the ways suggested by the Royal Commission of New South Wales, viz, (1) for sport, especially in coursing, (2) for their skins, and (3) for food.

The pursuit of the jack rabbit furnishes excellent sport with the shotgun or rifle as well as to the mounted rider eager for a trial of speed with hounds. It is often a difficult matter to get a shot if the rabbit happens to be somewhat wary, but on the other hand, if the game is abundant and not too shy, large numbers may be readily killed.

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[1] Final Rept. Royal Com. Inquiry Exterm. Rabbits, Australasia, 1890, p. 4.

[2] Rept. Proceedings Conference Rabbit Pest, New South Wales, Sydney, 1895, p. 7.

In one of the large Colorado hunts, which are conducted mainly for sport, two men shooting together at Lamar, in December 1894, secured 412 rabbits in two days. For the rifle, a jack rabbit on the run makes a fine target, and one requiring skill and steadiness to hit. Hunting on horseback with shotguns is considered much more exciting than on foot and requires considerable skill in riding as well as in shooting. Hunting the jack rabbit with hounds, however, is a form of sport which seems to be increasing in popular favor, notwithstanding the fact that it is considered cruel by some.

COURSING.

The adaptability of the large hares for coursing has long been recognized. They are certainly superior in speed to any of the smaller rabbits, but whether they are better than the Old World Hare is still an open question. Thus far the evidence seems to be in favor of the jack. Says Van Dyke[1] in speaking of coursing in California:

> A dash after the hare on a good horse and behind good dogs is one of the most charming of outings. The horse enjoys the sport as well as the dogs do, and tries his best to outrun the procession. The ground flies beneath you, the surrounding mountains swim in a haze, the whole amphitheater seems to turn around while you are standing still. Vainly the hare twists and sends the dogs spinning ahead in confusion, while he scuds away on his new tack without the loss of an instant, so far as you can see. All ordinary dogs fall out of the race. Even the wiry and swift coyote, though he loves hare more than anything else, rarely if ever feels hungry enough for a stern chase. But if the greyhounds are good and the brush not too near, the hare's doubling only postpones his end, however untiring his foot, or frequent his twists. Vainly he lays his ears flatter upon his neck and lets out another link of his reserved speed. Before he has made many turns he is caught—perhaps in mid-air—and the dogs and hare go rolling over in a heap together.

Coursing began in California in the early sixties, and has since been carried on with more or less spirit by various clubs. About twenty years ago the old Los Angeles Coursing Club used to follow the jack rabbits with greyhounds on the mesa near Pasadena, and women as well as men took part in the sport.[2] In 1872 the Pioneer Coursing Club of San Francisco held the first of a series of meetings at Merced. Since 1890 the meetings of the Interstate Coursing Club have been held at this place, which has become one of the principal coursing centers on the Pacific Coast. Other meetings have been held at Newark, San Francisco, and near Los Angeles.

The American Coursing Club was the first club east of the Rocky Mountains to use jack rabbits, and in October, 1886, inaugurated a series of annual meetings which were continued up to 1892 on the Cheyenne bottoms, near Great Bend, Kans. In 1894 and 1895 the club met at Huron, S. Dak. The National Coursing Association, of Hutchinson, Kans., was organized in 1888, with a capital stock of $50,000, and

[1] The Land of Sunshine, Los Angeles, Cal., III, Aug. 1895, pp. 116–117.

[2] Forest and Stream, XXVIII, Jan. 27, 1887, p. 3.

flourished for two or three years. Its object was to develop coursing in the United States, by breeding rabbits on their own soil and shipping them to various parts of the country in order that meetings might be held in the large cities and a more general interest aroused.[1] The association had 320 acres at Hutchinson inclosed with a wire mesh fence, and imported jack rabbits from California, New Mexico, and Wyoming and turned them loose in this park where in a few months a large number were collected. 'Inclosed coursing,' i. e. running the rabbits in an inclosure instead of on the open plain, was introduced at the meeting, held on October 23, 1888. A track half a mile long and 75 yards wide was arranged inside the park. The rabbits were started at one end of the track and at the other were allowed to escape from the hounds, through small openings, into a pen, where they were caught for use in another race.[2] The National Coursing Association held meetings in 1889 at St. Louis, Mo., and Louisville, Ky., and fifty jack rabbits were shipped from the park at Hutchinson to be used in the latter meeting. In 1890 it held a series of meetings at St. Louis, Kansas City, and St. Joseph, Mo.; Colorado Springs and Denver, Colo.; Omaha and Lincoln, Nebr., and Council Bluffs, Iowa.

Coursing has received a wonderful impetus in the West during the last ten years largely through the work of these two clubs, the Interstate Coursing Club of Merced, Cal., and the Occidental Club of Newark, Cal. Since 1890 numerous local clubs have been organized in Montana, South Dakota, Nebraska, Kansas, Texas, Colorado, and southern California, and no small number of rabbits are required annually for these meetings.

The demand for rabbits for this sport seems to have been largely instrumental in bringing about the rabbit drives in California, and as many as a thousand or more have been obtained in one of the large drives. Nearly all the rabbits for coursing in this State come from the San Joaquin Valley. Some of them are caught near Goshen, where they are shipped in coops, containing 24 single stalls arranged in two rows. From 50 to 100 are sometimes required for a single meeting, and the wholesale price varies from $5.50 to $9 per dozen.

At Wichita, Kans., and Merced, Cal., several persons regularly trap rabbits for coursing. At Wichita, Mr. Chas. Payne captures jack rabbits by means of a net about a mile in length, made of common cotton seine twine, which is stretched straight across a field. On one side are attached short nets at an angle with the main net, forming a number of V's. The rabbits are driven toward the trap by 6 to 10 men on horseback, and 10 to 20 rabbits are considered a good catch for one day. Shipping boxes are so arranged that each animal is in a separate compartment, and the largest hold about a dozen rabbits. Some of these

[1] Am. Field, XXX, Nov. 24, 1888, p. 504.

[2] See illustrated article on "Jack Rabbits and Inclosed Coursing," by M. E. Allison, in Am. Field, XXXIII, Apr. 26, 1890, pp. 395-396.

jack rabbits bring $2 apiece, and they have been shipped to various points in the United States and Canada, and even to England. Last winter (1894–95), between 200 and 300 were furnished to the St. Louis Coursing Association alone.

SKINS.

Rabbit skins are used in greater quantities than those of any other animals except the true fur-bearing mammals. At present skins of jack rabbits have little commercial value, and no attempt appears to be made to utilize them on a large scale. It seems strange that where the animals are slaughtered in such numbers the skins are not made to yield a fair profit, as is done with those of other species. Their use for fur seems to be restricted mainly to the Indians.

The Piutes and other tribes of the Great Basin formerly relied to a considerable extent on the rabbit for furnishing their scanty supply of clothing, and in Idaho, Nevada, and Utah killed large numbers of jack rabbits for this purpose.

Says Bancroft in speaking of the Indians of this region: "On the barren plains of Nevada, where there is no large game, the rabbit furnishes the only clothing. The skins are sewn together in the form of a cloak, which is thrown over the shoulders, or tied about the body with thongs of the same. In warm weather, or when they can not obtain rabbit skins, men, women, and children are, for the most part, in a state of nudity." (Native Races of the Pacific States, I, 1874, pp. 423–424.)

Mr. Vernon Bailey, chief field naturalist of the division, who has traveled extensively in this region and seen the robes in use among the Indians, has kindly contributed the following notes:

A good robe serves an Indian both for clothing and for bedding. It is exceedingly light, soft, and warm, and is easily carried in a small roll on the horse or in the pack when not in use. A Piute with an old shirt, a pair of breeches, moccasins, and one of these robes is well equipped for traveling, even in cold weather. In the wickiup the robe is thrown down and serves as a seat during the day and for a bed at night.

Robes of jack rabbit skins are common articles of clothing among the Piute and Mohave Indians. I have seen them among the Pyramid Lake Indians, the Piutes in Reese River Valley, Nevada, and the Mohaves at Fort Mohave, Ariz. They are usually 6 or 7 feet square, large enough to wrap around the body and entirely cover the person. They are made of twisted strips of jack rabbit skins laid parallel close together and fastened at short intervals with strings. The skins, apparently, are not tanned, but the robes are as soft and pliable as a blanket, and by twisting the strips the fur is thrown on both sides. These robes are generally valued at $6 to $8, but the Indians seem reluctant to part with them. One old Mohave upon being asked to sell his robe, refused, saying: "Me no make 'em. Hualapai make 'em, me buy 'em."

Jack rabbits were doubtless used also by the Indians of California, although to a less extent. The Miwok, a tribe whose territorry extended from the crest of the Sierra Nevada to the San Joaquin River, and from the Cosumnes to the Fresno in a part of the San Joa-

quin Valley where the jack rabbit is now extremely abundant, used rabbit skins for making robes. They cut the skins into narrow strips, and after drying them in the sun, laid them close together and made a rude warp, by tying or sewing strings across at intervals of a few inches.[1]

In order to show some of the uses to which jack rabbit skins might be put, it will be necessary to refer briefly to the general trade in rabbit skins and some of the ways in which the lower grades are utilized. The annual collection of English rabbit skins is about 30,000,000, and 50,000 to 80,000 dozen (600,000 to 960,000) are imported from France and Belgium. These skins are dyed and sold for fur to be used for caps, boas, muffs, and trimmings of various kinds, and are used for felting, especially in the manufacture of hats. Skins for felting are cut open, washed, and the long hairs pulled out with wooden knives; the fur is then cut off by machinery, sorted, and blown by air. The fur from different parts of the body is separated and sold at different prices. The best Coney back wool used in the manufacture of felt hats brings from 5s. to 7s. 6d. per pound.[2]

In the United States skins of native rabbits are used for fur, if at all, only for trimmings, as the hair is too brittle and they have very little underfur. Large numbers, however, are used for felt in the manufacture of hats. It is estimated by one of the leading furriers in New York that 1,500,000 native skins are collected annually in this country. In addition to these, rabbit skins are imported, not only from Great Britain and the continent of Europe, but even from Australia. Native skins are mainly those of the cottontail (*Lepus sylvaticus*), and the supply is derived largely from Maryland, Virginia, and North Carolina. They are assorted into three grades, 'primes,' 'seconds,' and 'culls.' Prime skins are those of full-grown animals with bright pelts; 'seconds,' of half grown animals; while the torn or imperfect pelts are classed as 'culls.' The prices range from 1¼ up to 4 cents apiece, averaging during 1895 about 1¾ to 2 or 2½ cents for the best skins. Imported skins are considered superior to those of "cottontails," averaging in value about 3½ cents each, although the best French rabbit skins are worth 5 cents. One of the New York dealers reports that skins of the native hare, probably the Varying Hare (*Lepus americanus*), are worth 6 cents each, but that very few are received in a season. England, however, in 1891 received 36,286 skins of the American Varying Hare from the Hudson Bay Company, and 50,000 from other traders. It may be stated here that the Hudson Bay Company has been shipping rabbit skins to England for more than one hundred years. Most of these are skins of *Lepus americanus*, and according to Poland[3] the total number exported between 1788 and 1890

[1] Powers, Tribes of California, Cont. N. Am. Ethnology, Vol. III, 1877, p. 351.

[2] Poland, Fur-bearing Animals, London, 1892, p. 281 et seq.

[3] *Loc. cit.*, pp. xxiii–xxvii, 276–277.

was 3,333,933, or an average of 39,750 for the eighty-four years for which statistics are available.

Rabbit skins have formed a large item of export from Australasia, chiefly from the colonies of New Zealand, Tasmania, and Victoria, for nearly twenty years. In Victoria the number exported increased nearly fifteenfold from 1876 to 1893, when it reached 10,374,154. Shipments from New Zealand were trebled between 1879 and 1893, reaching in the latter year over 17,000,000, valued at about £140,000 or nearly $700,000. The following table shows the number of skins exported from Australasia so far as figures are available:

*Export of Rabbit Skins from Australia, New Zealand, and Tasmania.**

Year.	New Zealand.		Tasmania.		Victoria.		S. Australia.	
	Number of skins.	Value.	Number of skins.	Value.	Number of skins.	Value.	Pack-ages skins.	Value.
1873	†36,716	£1,263	.....	.....	.....	.....	.....	.....
1874	56,504	1,878	.....	.....	.....	.....	.....	.....
1875	111,142	3,913	.....	.....	.....	.....	.....	.....
1876	311,632	4,418	.....	.....	724,985	£6,711	.....	.....
1877	918,236	8,630	.....	.....	700,565	5,790	.....	.....
1878	636,409	33,460	.....	.....	711,844	6,206	.....	.....
1879	5,384,506	46,799	.....	.....	1,036,372	7,322	.....	.....
1880	7,505,616	66,976	.....	.....	3,309,408	21,674	.....	.....
1881	8,514,685	84,774	.....	.....	4,473,108	32,217	.....	.....
1882	9,198,837	88,725	1,881,040	£15,699	4,929,432	37,538	.....	.....
1883	9,891,805	100,955	1,735,856	20,367	4,245,596	30,364	.....	.....
1884	9,807,665	107,514	1,730,628	14,537	4,963,371	37,243	.....	.....
1885	9,168,114	85,754	2,872,896	22,572	3,424,259	23,548	86	£883
1886	8,546,254	65,694	1,184,862	7,400	910,609	6,800	35	602
1887	12,743,452	111,172	2,181,068	17,555	2,663,314	16,294	398	7,534
1888	11,809,407	91,908	1,961,576	12,661	3,967,533	20,759	725	9,578
1889	11,342,778	96,039	1,819,547	11,369	3,429,015	12,303	208	3,081
1890	12,543,293	111,880	2,991,316	24,362	4,913,351	25,667	594	11,320
1891	14,302,233	126,251	3,241,351	19,571	6,359,210	31,367	613	9,239
1892	15,899,787	121,775	3,180,104	17,097	7,501,864	31,905	496	8,790
1893	17,041,106	138,952	3,590,474	23,278	10,374,154	55,039	419	6,958
1894	14,267,385	87,993	3,541,464	16,194	.....	.....	980	10,973
Total‡	180,037,562	1,586,723	31,912,182	222,562	68,637,990	408,747	4,554	68,958

The importation of Australian rabbit skins in London, as shown by reports of sales, aggregated 8,210 bales in 1890–91, and from July, 1894, to July, 1895, amounted to 13,140 bales, each averaging about 400 pounds and containing about 4,000 skins. The total number in 1894–95 was, therefore, about 52,500,000 skins, valued (at $70 per bale) at nearly $1,000,000.

It should be noticed that no less than one-third of the Australian skins sent to London are said to be exported to New York. There are now 20 cutters of hatter's fur in America, employing about 160 machines. Each machine will cut on an average 1,200 skins a day,

*Compiled from Statistics Colony New Zealand, 1881–1890; New Zealand Year Books, 1891–1895; Statistics Colony Tasmania, 1882–1894; Victorian Year Book, 1893, II, p. 262, 1894, I, p. 437; Statistical Register South Australia, 1885–1894.

†The returns from New Zealand for 1873–1880 are taken from U. S. Consular Repts., VI, 1882, p. 122. The values are only approximate, being reduced from dollars at the rate of £1=$5—the rate apparently used in obtaining the value for 1881 in the Consular Report. Returns for 1891–1894 are taken from the Year Books under reports of export of wool.

‡The total exports from Australasia can not be obtained from these figures as some of the skins from New Zealand and Tasmania were shipped to other colonies, particularly Victoria, and such skins may have been reexported; e. g., the direct exports from Tasmania to Europe from 1886 to 1892 formed a very small percentage of the total exports, the bulk of the skins being shipped to Victoria.

producing 75 pounds of cut fur. If all the machines were kept running for two hundred and fifty days per annum they would require 48,000,000 rabbit and hare skins. The output of fur would be about 3,000,000 pounds, which, valued at 85 cents per pound, would give a total of $2,550,000; deducting $600,000 for cost of cutting, estimated at 20 cents per pound of fur, the value would be $1,950,000.[1]

Jack rabbit skins apparently have not been utilized to any great extent, but if they can not compete with the best native or foreign skins in quality, they certainly can be used for many purposes for which skins of inferior grades are employed. In addition to being utilized for fur and felt, rabbit skins are used for making gelatine, jujube, sizing, and glue, and in Spain it is said that the hair is sometimes used in place of down. For these purposes skins of jack rabbits ought to be as good as any. If skins can be shipped from Australia to the United States by way of London and then sold at a profit for 3 cents apiece, there ought to be a large market for native skins. Jack rabbit skins can be collected with such facility in the West that they could probably be sold at a lower price than those of the cottontail or any imported skins of the same grade and still allow a margin of profit.

JACK RABBITS AS GAME.

Between the months of October and March, jack rabbits are sold in considerable quantities in the larger cities of the United States from San Francisco to Boston, and from St. Paul to New Orleans. Both the Prairie Hare and the Blacktailed Jack Rabbit are shipped to Eastern markets, but in California the Texan Hare and the California Jack Rabbit are the only ones commonly sold. The business of handling this game is larger than is generally supposed, and while by no means equal to the trade in cottontails, is capable of being developed into an important industry to the mutual benefit of the consumer and of the farmer who suffers from the depredations of the rabbits.

PARASITES.

Many persons have a prejudice against eating jack rabbits because the animals are infested at certain seasons with parasites, or because the flesh is supposed to be 'strong.' This prejudice, however, is entirely unfounded. The parasites of the rabbit are not injurious to man; furthermore, the ticks and warbles occur at a season when the rabbits should not be killed for game, while the tapeworm can only develop in certain of the lower animals, e. g., in the dog or the coyote. The most important parasites of the jack rabbit are ticks (*Ixodes*) and larvæ of a fly (*Cuterebra*) and of a tapeworm (*Tænia*). Ticks are especially troublesome during the summer and may sometimes be found clustered about the ears in great numbers. A large fly of

[1] These figures have been kindly furnished by Messrs. J. P. McGovern & Bro., importers and fur brokers, of New York.

the genus *Cuterebra* attacks these hares as it does deer, squirrels, and wood rats, and punctures the skin in order to find a suitable place to lay its eggs. The egg hatches soon after being deposited, and the parasitic larva, becoming incased in a capsule immediately beneath the skin of its host, forms a lump sometimes an inch or more in length, which is usually known as a 'warble.' These warbles are most often seen in July or August. The larva emerges from its case in due time as a perfect insect, and the wound heals, leaving little or no scar. On some of the rabbits brought to market large 'water blisters' or 'boils' are occasionally found, which are the larvæ of a tapeworm (*Tænia serialis*). This larva is called *Cœnurus serialis*,[1] and has been found in the California Jack Rabbit (*Lepus californicus*), the Prairie Hare (*L. campestris*), the Old World Hare (*L. timidus*) and rabbit (*L. cuniculus*), the coypu of South America (*Myopotamus coypu*), a species of squirrel (*Sciurus*), and in the horse.[2] *Cœnurus* does not develop into the adult tapeworm in any of these animals; but in the dog, and in the coyote, which eats many rabbits, it reaches the adult stage.

It is sometimes said that trichinosis may result from eating jack rabbits, and such reports are occasionally circulated by the press. The State board of health of Iowa recently published a report on trichinosis, in which it referred to the source of the disease in the following terms, implying that there was danger of infection from rabbits: "In all cases known the hog has been the source of the disease in human beings, so it may be said of nearly, if not all cases, that they are caused by eating trichinosed pork, although the rabbit and the hare are considered not behind the hog in susceptibility to trichinosis. Hogs become infected mostly from rats, and rabbits and hares become mouse hunters in winter." (Seventh Biennial Report, 1893, p. 80.)

Hares and rabbits rarely if ever eat mice or other small mammals, and the danger of infection from this source is of no practical importance. It may be confidently stated that there is no authentic case of trichinosis in rabbits on record, except in those which have been purposely infected. Until it can be shown that trichinæ are actually found in our native species, no danger need be apprehended in using rabbits as game.

HOW THE GAME IS KILLED AND SHIPPED.

It would be interesting to know the extent to which jack rabbits are sold in the United States, but unfortunately it is practically impossible to obtain complete statistics. All that is possible is to cite a few cases which will give some idea of the business. A correspondent in Goshen, Cal., states that he sent at one time (February 16, 1889), after

[1] For a popular account of these 'blisters' see an article entitled "Cœnurus of the Hare," by Katherine Brandegee, in Zoe, Vol. I, Nov., 1890, pp. 265–268.

[2] This list of hosts of *Tænia serialis* has been kindly furnished by Dr. C. Wardell Stiles, Zoologist of the Bureau of Animal Industry, U. S. Dept. of Agriculture.

one of the large drives, as many as 400 jack rabbits to the San Francisco market. In the fall of 1892 one of his neighbors made a business of market hunting, sometimes killing six dozen jack rabbits per day, and in one week he secured 26 dozen. This man shot from a one-horse buckboard, and nearly all the game was retrieved and brought to the wagon by his setter. During the autumn of 1894 three men and a boy killed about 200 rabbits per day and sent them to San Francisco. The shipments from Goshen during the month of November 1894, amounted to about 1,000 jack rabbits, weighing 3,860 pounds.

Two hunters in Kern County, Cal., made a series of thirteen rabbit drives last winter for the purpose of obtaining rabbits for market. These drives were made in various localities near Delano, beginning on November 14, 1894. More than 25,000 jack rabbits were secured and about two-thirds of them were shipped, bringing from 50 cents to $1.25 per dozen in San Francisco. The venture, however, proved unsuccessful, as the expenses for sacks, twine, commission, and transportation amounted to 61 cents per dozen and many of the rabbits spoiled in transit. It was claimed that if the bounty had not been removed there would have been a profit instead of a loss.

Many jack rabbits are shipped to market from Kansas. Norton, Winona, and other places in the western part of the State send the game to Denver, while from points in central and southern Kansas a good deal is shipped direct to New York and other Eastern cities. A commission merchant in Great Bend, Kans., states that he shipped about 4,200 jack rabbits (350 dozen) during the winter of 1893–94 and about 6,000 (500 dozen) during the winter of 1894–95. Most of this game was sent to Kansas City, Chicago, New York, Baltimore, and Boston. Considerable quantities are also shipped to the New York market from Independence, Kans. A single invoice of several hundred pair was received from that point in the winter of 1889–90, and a commission merchant writes that his shipments from Independence have been increasing gradually during the last few years at the rate of 200 to 300 per year. In the winter of 1894–95 he shipped about 1,600 jack rabbits direct to New York. McPherson County is one of the main shipping centers in the State, and a dealer in Marquette writes that he handled 2,646 jack rabbits last season. The freight traffic manager of the Atchison, Topeka and Santa Fe Railroad reports that three carloads were forwarded from McPherson in the winter of 1893–94, two consigned to Chicago and one to New York. Last season the McPherson Produce Company handled 7,927 jack rabbits, and the total shipments from that place average about five carloads, or 20,000 rabbits a season, 75 per cent being sent to New York. The game is not often forwarded in carload lots, but is usually shipped with dressed poultry in ordinary refrigerator cars.

The Black-eared Jack Rabbit (*Lepus melanotis*) is the principal species shipped from Kansas, but the white-tailed Prairie Hare (*L. campestris*)

is sold in even greater numbers in Eastern cities, and the bulk of the supply probably comes from the Dakotas, Nebraska, Minnesota, and Iowa. In Newcastle, Wyo., a single hunter killed over 100 Prairie Hares for market during the season of 1893–94. One dealer in Pierpoint, Day County, S. Dak., reports that he has shipped from 1,200 to 1,500 per annum for the last three years, and a correspondent in Watertown, S. Dak., writes that probably 50,000 rabbits were killed in Codington County, S. Dak., last season, although not all were used for food. The severe winter following the drought of 1894 resulted in the destruction of larger numbers than usual, and no doubt many persons in Dakota and Nebraska gladly availed themselves of this source of supply.

As already stated, part of the game in California is secured by means of rabbit drives. In eastern Colorado large quantities are killed during the annual hunts at Lamar and Las Animas, but as the rabbits are killed for sport, and not especially for market, many of them are donated to the poor of Denver and Pueblo. In Kansas large numbers of jack rabbits are killed after heavy snowfalls, and in Chautauqua and Montgomery counties it is said that the farmers sometimes bring them in by the wagon load; the hunters usually receive about 10 cents apiece for them. Near McPherson one method of hunting is to stretch a wire between two wagons about 200 yards apart, and allow it to drag in the grass or stubble as they proceed. As the rabbits are started they are shot from the wagons or by two hunters who follow behind. In this vicinity the prices vary from 15 cents apiece in October, down to 5 cents in January.

Jack rabbits are shipped to market either by express or freight. At Goshen, Cal., they are cleaned and hung up over night to cool off, and are then simply placed in barley sacks (each holding from 25 to 30), and sent by express. Kansas shippers usually forward the game by ordinary freight during cold weather, but at other times in refrigerator cars. Some pack the rabbits without ice in boxes holding from 2½ to 3 dozen each; others wrap the game in paper or excelsior and pack it in barrels containing 4 or 5 dozen rabbits. Another method is simply to cord them up in refrigerator cars, thus saving the cost of packages and packing.

THE MARKET.

Jack rabbits usually bring from 75 cents to $3 per dozen, depending on the demand and the expense of shipping. In some cases they are sold at a much higher figure. During the winter of 1890 some black-tailed jack rabbits were sold at retail in the New York market at $1.50 per pair,[1] and in December 1895, a few Prairie Hares were retailed in the Washington market at $1 apiece.

[1] Mearns, Bull. Am. Mus. Nat. Hist., II, Feb., 1890, p. 298, footnote.

The following table shows the ordinary market prices in some of the larger cities for the season of 1894–95:

*Market Prices of Jack Rabbits, 1894–95.**

City.	Date.	Price per pair.	Price per dozen.	Average price per dozen during season.
San Francisco, Cal.	Oct. 20, 1894		$0.50–$1.00	$0.67–$1.00
	Oct. 27–Nov. 24, 1894		.75– 1.00	
	Jan. 12, 1895		.75– 1.00	
	Feb. 9, 1895		1.00	
Denver, Colo.				1.25– 2.50
Chicago, Ill.	Dec. 1, 1894		2.00– 3.50	1.75– 2.66
	Dec. 15, 1894		1.50– 2.00	
	Feb. 23–Mar. 2, 1895		1.75– 2.50	
New Orleans, La.				1.50– 2.50
				2.00– 2.75
St. Paul, Minn.				1.75– 3.00
St. Louis, Mo.				2.25
Boston, Mass.	Jan. 26–Feb. 2, 1895	$0.25–$0.50		1.50– 3.00
New York, N. Y.	Dec. 22, 1894	.40– .60		2.40– 3.45
	Dec. 29, 1894	.40– .55		
Washington, D. C.	Jan. 26–Feb. 2, 1895		3.00	3.00

*Returns for Boston, New York, and Chicago are taken from the market review in the American Agriculturist, Vols. LIV and LV; for San Francisco, from the Pacific Rural Press, Vols. XLVIII and XLIX; figures for St. Louis have been kindly furnished by the St. Louis Poultry and Game Company; for St. Paul, by R. E. Cobb; for New Orleans, by Messrs. H. & S. Blum, and for Denver, by H. O. Munger & Co.

As might naturally be supposed, some of the largest markets for jack rabbits are in the cities of California where the game is sold at a lower price than elsewhere. San Francisco probably uses more than any other single city in the United States, and it is said that this game is received during the winter months at the rate of 100 to 150 dozen per day. An estimate obtained by the board of trade from the commission merchants places the total number consumed per annum at about 96,000. The game is supplied principally by the counties of Fresno, Merced, and Tulare, in the San Joaquin Valley. Los Angeles is supplied by the southern counties of Los Angeles, Orange, Riverside, San Bernardino, and San Diego. The number sold as estimated by the Chamber of Commerce, averages from 12 to 15 dozen per week the year round, or approximately 7,500 to 9,200 per annum, most of which is received during the winter months.

An estimate furnished by the Chamber of Commerce places the number of jack rabbits sold in Salt Lake City, Utah, during the winter of 1894–95 at 10,000 to 15,000. Many more were given away, and the secretary, Mr. E. F. Colburn, explains that perhaps more were consumed than usual, owing to the fact that the rabbits were slaughtered in large numbers in regular hunts and were donated to the poor. In Denver, Colo., large numbers of jack rabbits are donated to the poor, but many are also sold as game. One commission house reports that for the last ten years they have handled from 13,000 to 15,000 each season, although large quantities are rarely found in market at any one time. The game comes from the eastern part of the State and from western Nebraska and Kansas. Omaha, Nebr., is supplied by the western part of the

State and by Wyoming, largely from the region between the Fremont, Elkhorn and Missouri Valley and the Burlington and Missouri River railroads. No reliable statistics of the number consumed in Kansas City, Mo., are at hand, the estimates ranging from a few hundred dozen up to about 75,000.

Texas probably furnishes most of the rabbits sold in the markets of its principal towns as well as some of those in New Orleans. Only a limited number of 'jacks' are used in New Orleans—probably not more than 25 per cent of the total number of rabbits sold—and these are shipped mainly from points along the Kansas City, Fort Scott and Memphis Railroad.

Minneapolis and St. Paul, Minn., receive their main shipments from North and South Dakota and Minnesota. It is reported that 12,000 jack rabbits (1,000 dozen) were handled by a single commission house in St. Paul during last winter, probably nine-tenths of which were obtained from the Dakotas, the remainder being received from Minnesota and Iowa.

Estimates of the number of jack rabbits sold in the markets of some of the cities west of the Mississippi River have been obtained from boards of trade, chambers of commerce, or reliable commission merchants, and are shown in the following table. Such figures are only approximate, but in most cases are based on the sales of the season of 1894–95:

Estimates of Jack Rabbits sold in Western Cities.

City.	Number of rabbits.	Authority.
Los Angeles, Cal.	7,500–9,200	Chamber of Commerce.
San Francisco, Cal.	96,000	Board of Trade.
Denver, Colo.	30,000	H. O. Munger & Co.
Pueblo, Colo.	1,000	Jno. M. Killin & Co.
New Orleans, La.	2,500	Bennett & Co.
Minneapolis, Minn.	25,000	Produce Exchange.
St. Paul, Minn.	*12,000	R. E. Cobb.
Kansas City, Mo.	†25,000	
St. Louis, Mo.	35,000	St. Louis Poultry and Game Co.
Omaha, Nebr.	60,000	Peycke Bros.
Salt Lake City, Utah.	10,000–15,000	J. P. White.

* Handled by a single commission house. † Approximate.

Most of the jack rabbits sold in Chicago, St. Louis, New York, Boston, Philadelphia, Baltimore, and Washington seem to come from the Great Plains—from Kansas to North Dakota—but the attempt to secure accurate statistics from Eastern cities is almost hopeless, as quantities of the large Varying Hares (*Lepus americanus*) are also received and sold indiscriminately with jack rabbits under the name of hares.

These data will give some idea of the extent to which jack rabbits are shipped to market. The total number sold in the cities mentioned above is about 300,000. Allowing an equal number for local consumption in small towns and for those sold in other cities would

give 600,000 as a very rough approximation of the total number consumed in the United States per annum. Estimated at the rate of $1.50 to $2 per dozen the total value would be about $75,000 or $100,000. This, however, is only a small proportion of the total number of rabbits used as game, since cottontails are sold everywhere in much larger quantities.

In connection with these figures it will be interesting to compare the number of rabbits sold in one of the large cities of Australia. Melbourne, the capital of Victoria, according to the census of 1891, had a population of 490,896—somewhat more than that of San Francisco, Cal. The following table from the Victorian Year Book for 1893 (Vol. II, p. 262) shows the number of rabbits sold in Melbourne during the seven years from 1886 to 1893:

Number of Rabbits shipped to markets of Melbourne, Australia.

Year.	Number of couples of rabbits—		
	Sold.	Condemned.	Total.
1886–87	346,856	4,460	351,316
1887–88	418,618	2,272	420,890
1888–89	474,384	13,458	487,842
1889–90	606,568	11,567	618,135
1890–91	676,796	5,955	682,751
1891–92	572,426	17,977	590,403
1892–93	617,773	19,275	637,048
Total couples	3,713,421	74,964	3,788,385
Total rabbits	7,426,842	149,928	7,576,770
Average per annum	1,060,977	21,418	1,082,395

Evidently rabbits are more extensively used for food in Australia than in this country, but in comparing the figures it should be remembered that the statistics for Melbourne include the total number of rabbits sold, whereas those given for jack rabbits consumed in the cities of the United States represent only a part of the rabbits sold.

England imports, it is said, about 124,000 hundredweight of rabbits yearly for food, which are valued at £342,000.[1]

So far as known, little or nothing has been done in the United States in the way of canning jack rabbits, although the subject has been discussed occasionally. When rabbit driving was being agitated in Tulare County, Cal., the Visalia Delta of January 26, 1888, published an article on "Money in Rabbits," which advocated canning some of the jack rabbits which were being killed in large numbers at that time. The article was based mainly on statistics of the industry in New Zealand, and apparently the suggestion has never been adopted, at least not on a commercial scale. After making special inquiries concerning the utilization of rabbits, Mr. C. D. Willard, secretary of the Los Angeles Chamber of Commerce, reports: "No use whatever is made of the

[1] Simmonds, Commercial Dictionary of Trade Products, London, 1892, p. 486.

skins here, and as far as I can learn no one has ever heard of canning the meat." Mr. D. R. Payne, of Independence, Cal., writes under date of September 18, 1895: "Many years ago there was a cannery engaged in putting up all kinds of wild game, and probably they used some jack rabbits, but during my long residence in California I never saw them in the market put up in cans."

There seems no good reason why rabbits can not be profitably canned, and some commission merchants claim that this would relieve the glut in the market at certain times in winter and bring about better prices. Several preserving companies are in operation in Victoria and in New Zealand. In October, 1886, Hon. James M. Morgan, then United States consul-general at Melbourne, Australia, reported that "in the Colac and Camperdown district [Victoria] a preserving factory was started some few years back and operations carried on with vigor, the factory working each year for about six months, from March to October, and during that period purchasing from 750,000 to 1,000,000 rabbits, the price paid being about 2s. 6d. per dozen. These rabbits are nearly all obtained from the stony rises and surrounding districts, as they can not be sent to the factory in proper condition from any great distance." (U. S. Consular Repts. for Dec., 1886, XX, pp. 482–484.)

GENERAL SUMMARY AND CONCLUSIONS.

(1) The various species of jack rabbits are all more or less alike in habits, and all feed largely on bark and herbage.

(2) When food is easily obtained, and particularly on newly cultivated land, the rabbits increase rapidly and do great damage to crops. The black-tailed species are more gregarious than the Prairie Hare, and as a rule are more destructive.

(3) The best means of protecting crops from the attacks of rabbits, and in fact the only method which can be relied on, is the use of rabbit-proof fences.

(4) Under favorable circumstances great numbers of jack rabbits may be killed by drives or large hunts, but this means will only serve to reduce their numbers, and can not be used to exterminate the pests.

(5) Bounties or other direct expenditures of public money for the destruction of rabbits have failed to accomplish the desired object. Bounty laws afford unusual opportunities for fraud, and the amounts expended are often so large as to be a serious burden on the county or State.

(6) The extermination of rabbits can only be accomplished by cooperation on the part of individual farmers or landowners. The work of destruction can be most effectually and economically done when the animals have suffered an unusual decrease in numbers, either from a severe winter, lack of food, or an epidemic.

(7) Commercial utilization is the most promising and least expensive method of keeping these pests in check in localities where they are

unusually abundant; but returns from this source will only partially offset the losses sustained on account of injuries to crops.

(8) Jack rabbits may be used for coursing, for their skins, or for food. The United States imports annually millions of rabbit skins for felt and other purposes. The skins of jack rabbits could probably be used for many purposes for which the cheaper grades of imported skins are now utilized, and could be collected so cheaply as to leave a margin of profit.

(9) The consumption of jack rabbits for food amounts to about 600,000 per annum, and is gradually increasing. This game can be obtained in considerable quantities on the plains and on the deserts of the Great Basin, and may be profitably shipped to Eastern markets to the mutual benefit of the farmer and the consumer.

(10) In America the rabbit question never has, and probably never will, assume the proportions it has assumed in Australia. The jack rabbits of the United States are all indigenous species and ordinarily are held in check by natural enemies and by disease. Although local conditions may sometimes favor their temporary increase, yet natural agencies, aided by the persistent and constantly increasing war of extermination, are gradually, but none the less surely, diminishing their numbers.

ARTICLES ON RABBITS.

The following list contains references to only a few of the more important articles on jack rabbits and the rabbit pest in Australia. Some of these papers have been referred to in scattered footnotes, but are here grouped under several headings for convenience of reference. Very little has been published on rabbit driving, and this mainly in the form of brief notes and descriptions of single drives which are mentioned below.

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